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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 716

OFFICE OF THE SECRETARY

Contribution from the Office of Farm Management
W. J. SPILLMAN, Chief

Washington, D. C. PROFESSIONAL PAPER September 26, 1918

A FIVE-YEAR FARM MANAGEMENT SURVEY IN PALMER TOWNSHIP WASHINGTON COUNTY, OHIO, 1912-1916

By

H. W. HAWTHORNE, Scientific Assistant

CONTENTS

	Page
General Nature of the Area and the Study	1
Objects of the Study	1
Summary of Results	2
General Description of Area	3
Method of Study	10
A Five-Year Study of 25 Farms	11
A Study of 73 Farms, by Size and Quality of Business	47

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	Page.		Page.
General nature of the area and the study	1	Method of study	10
Objects of the study	1	A five-year study of 25 farms	11
Summary of results	2	A study of 73 farms, by size and quality of business	47
General description of area	3		

GENERAL NATURE OF THE AREA AND THE STUDY.

This bulletin presents a study of a farm-management survey of 73 southeastern Ohio hill farms, on 25 of which the survey was conducted for five successive years, 1912 to 1916, inclusive.[1] All these farms are located in one township of Washington County. (See fig. 1.) In common with many other areas of the hill country drained by the Ohio River, the land here is fairly productive and comparatively low priced. The farms are some distance from railroad points, and the wagon roads are hilly and unimproved.

The findings for this area, though strictly applicable only to the farms surveyed, offer valuable suggestions to farmers located on the numerous similar areas of Pennsylvania, Ohio, Indiana, Illinois, West Virginia, and Kentucky.

OBJECTS OF THE STUDY.

The objects of this study were:

(1) To ascertain the type of farming followed and the profits realized in a long-established agricultural community of the hill

[1] During the first two years the survey was conducted in cooperation with the Ohio Agricultural Experiment Station. During the three succeeding years it was conducted by the Office of Farm Management alone.

country of Ohio where the price of land is comparatively low and railroad points are reached with considerable difficulty.

(2) To determine the importance of such factors as the size and the quality of the farm business as they affect the economic organization of farms in such an area.

(3) To bring out the farm practices that enable some farmers to excel others in single enterprises or in the entire farm organization.

(4) To determine how nearly the farm profits of a single year in such an area are indicative of those realized over a period of years.

(5) To note agricultural changes that may take place during a five-year period in such an area.

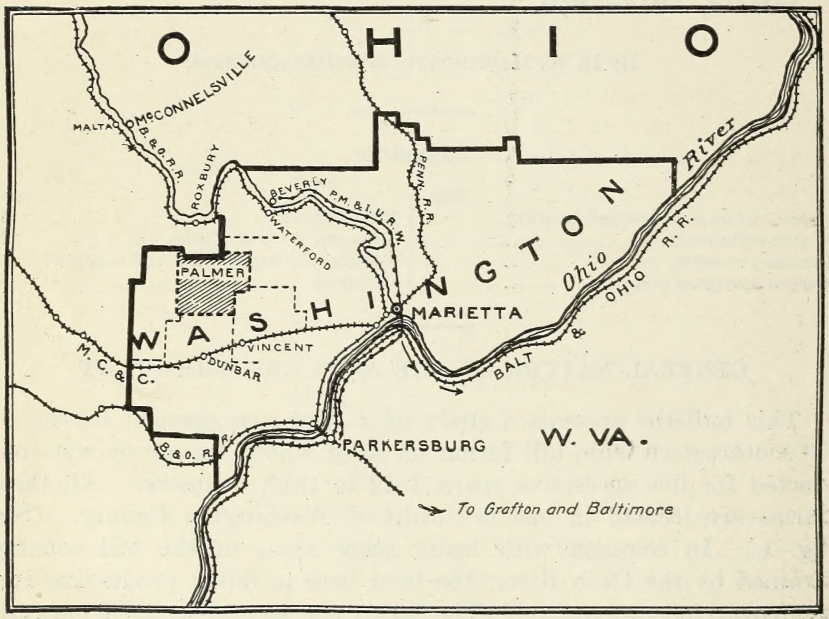

FIG. 1.—Map of Washington County, Ohio; Palmer Township shaded.

(6) To determine the yearly variations in crop yields, in prices received for products, in the quantities of the several products available for sale, and in the expenses of operating the farm business, and, so far as practicable, their effect upon the farm profits of the area.

SUMMARY OF RESULTS.

For five years the average annual sales of 25 farms were $925 per farm, and of this amount 45 per cent was required for operating expenses. With a fair rate of interest allowed on the investment the labor income averaged $187. Or, with a fair wage allowed for the farmer's labor, the return on the investment was 3.4 per cent. This was in addition to the value of food products, fuel, and use of house,

furnished by the farm without money cost. The value of such items was $325.

The farms averaged 156 acres, worth $30 per acre. One-half of the land was in pasture and one-fourth in corn, wheat, and hay. The crops were mostly fed to beef cattle, poultry, fine-wooled sheep, hogs, and work stock. Practically 75 per cent of the receipts was from the sales of live stock, including eggs, wool, and dairy products.

So far as profits were affected, one year was good, one poor, and three might be considered normal.

Profits varied widely. Some farmers made more than enough to support their families and were enabled to reduce indebtedness, improve their farms, buy more land, or make other investments. Others realized no more than enough to supply the necessaries of life. The two outstanding factors affecting such differences were the size and the quality of the business. On small farms, with poor crop yields and a poor quality of live stock, the sales but little more than covered expenses. On large farms, with good crop yields and good live stock, the sales far exceeded the expenses.

In five years there was a decided change from sheep to cattle. Sheep decreased 58 per cent and cattle increased 68 per cent. The decrease in sheep was greater on farms that kept sheep primarily for wool production than on farms selling lambs and wool.

When this study began, butter was the only dairy product sold; at the end of the five-year period several farmers were selling cream. The sale of dairy products increased $50 per farm.

Putting up silos aided several farmers to carry more live stock.

Corn yielded 44 bushels per acre for the five-year average, wheat 14 bushels, and hay 1.2 tons. Yields for the different crops were 50 to 100 per cent better some years than others, but in no case did all the good yields or all the poor yields fall in a single year. The amount of feed raised each year varied less than the yields of individual crops.

Price levels increased 23 per cent from 1912 to 1916, and operating expenses 11 per cent.

There were much wider variations in the amount of crops sold than in the live stock sold. For two years the quantity of all products sold approximated the five-year average, for two years it was above the average, and for one year decidedly below.

GENERAL DESCRIPTION OF AREA.

LOCATION.

Palmer Township, Washington County, the area selected for this study, is in the hill section of southeastern Ohio and is representative of much of the hill land drained by the Ohio River. The town-

ship is strictly rural. There are no towns within its borders, and only two country stores. (See fig. 2.) These serve as markets for such produce as butter, eggs, and poultry. A few small towns (not railroad points) lie within close proximity to the township, and some of the farmers do part of their trading there.

TRANSPORTATION FACILITIES.

A secondary line of the B. & O. R. R. extending along the Muskingum River from Zanesville to Marietta and Parkersburg and reach-

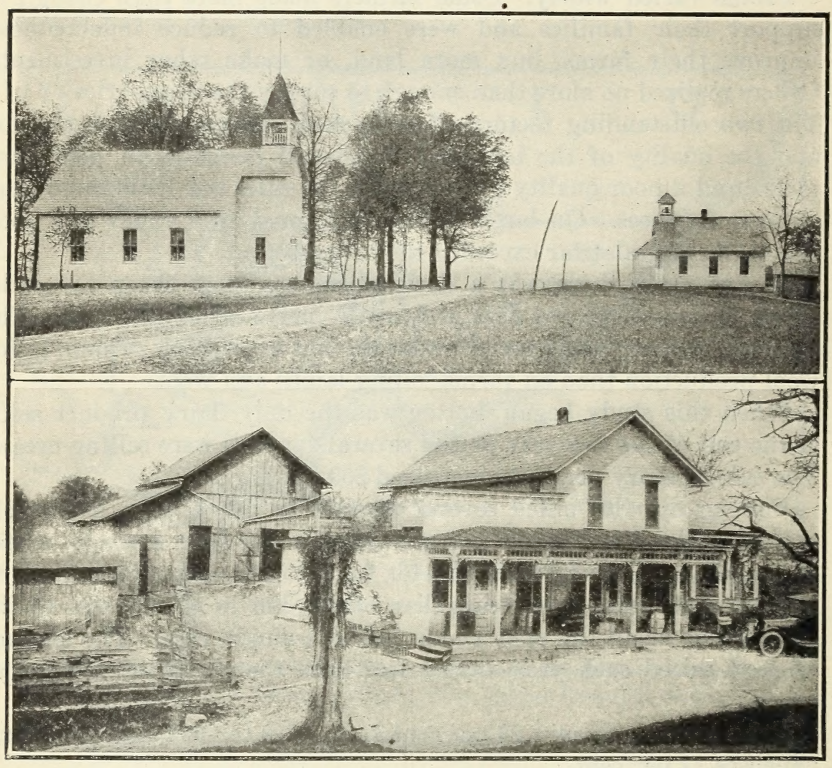

FIG. 2.—A representative church, schoolhouse, and country store. Palmer Township has three churches, seven schools, and two country stores.

ing to within 4 miles of the area furnishes railroad facilities for the farmers in the northern part of Palmer Township. Each terminus of this line connects with main lines of the B. & O. system. Another railroad through the hill section from Marietta to Palos, thence connecting with other lines to Columbus, reaches to within 5 miles of Palmer Township, and had furnished shipping facilities to those farmers living in the southern part until it was abandoned in the fall of 1916. The central part of the township is about equidistant from each of these railroads.

An electric line from Beverly to Marietta and Parkersburg, terminating within 6 miles of the northern boundary of the township, is of much service to these people in reaching Marietta, the county seat, a city of some 13,000 population. The average distance of all farms studied from their railroad market point is 6.3 miles, with a range of from 4 to 9 miles.

None of the wagon roads within this area are macadamized. Those extending to the railroad points are also unimproved except about 1 mile out from Waterford, the first half mile of which is paved with brick, and the second half mile macadamized. The wagon roads, often very hilly, are usually dry and smooth during the summer and fall seasons, but become very muddy or rough during the winter and spring months.

HISTORY.

In Washington County is the oldest white community within the State of Ohio, Marietta, situated where the Muskingum River joins the Ohio, having been settled in 1788. On May 19, 1851, what had formerly been parts of Waterford, Watertown, Roxbury, and Wesley Townships were organized into Palmer Township, which took its name from one of the pioneer families. The first settler in what is now Palmer Township moved there in 1796. Two great grandchildren of this pioneer are now farmers in the township. As early as 1806 a teacher was engaged to teach a school in Palmer Township. Religious meetings were customarily held in private houses until, in 1837, a Methodist church was built. The first store was opened about 1825. Contrary to the usual custom of making first settlements along the streams, those of Palmer Township were made on the higher plateau-like land back from the streams.

The early agriculture of this area differed little from that of the present day in the main crops grown or in the classes of live stock raised. Since the early settlement corn, wheat, and hay have been the important crops, and horses, cattle, sheep, hogs, and poultry the live stock kept. From time to time there have been adjustments and readjustments in the farm organization, which have resulted in variations in the comparative importance of different crops and of different classes of stock, but not in a permanent elimination of any of those named.

In 1902 or 1903 oil was discovered in the township. The development was rapid, reaching its maximum in 1905. After 1907 only an occasional well was drilled, until 1915, when development revived. Only 6 of the 25 farms upon which five-year records were taken and but 10 of the 73 farms included in this survey have had any oil production. Oil production has added somewhat to the income of some

of the farms studied, but all income from this source has been ignored in connection with the study herein presented.

The population of Palmer Township, by 10-year periods, was as follows: In 1860, 618; in 1870, 671; in 1880, 591; in 1890, 541; in 1900, 614; and in 1910, 621.

SOILS.

The soils of Palmer Township have been described under the general classification residual shale and sandstone soils.[1] These soils, underlain by shales and sandstone, have given rise to two distinctly different soil series, the Dekalb and the Upshur.

The Dekalb is represented in this township by a type known as Dekalb silt loam. The soil of the Dekalb silt loam is a grayish yellow or light yellowish brown mealy silt loam, varying in depth from 6 to 12 inches, with an average of about 9 inches. The typical soil has a smooth, velvety feel and is rather mellow and easily tilled, although it has a slight tendency to run together. In cultivated fields the surface soil when dry is usually a very light gray with a pale yellowish tinge, but when moist, as in freshly plowed fields, the color is more nearly a light yellowish brown. As a rule, the Dekalb silt loam has very little, if any, lime carbonate present, and over a large part of the area, particularly in poorly drained places, there is undoubtedly a deficiency of lime. On the whole, the Dekalb silt loam is not considered a very productive soil without fertilizers. One of the principal needs of this type is organic matter, which may be supplied by the growing and turning under of clover, rye, or other green manuring crops, or by the addition of stable manure, to which this soil gives a ready response. The texture of the subsoil is such that it is retentive of fertilizers, and a permanent improvement of the land may be brought about by proper cultivation and fertilizers.

The Upshur series is represented by the Upshur clay, which is known throughout the section where it occurs as "red clay land." The type consists of an Indian-red, purplish-red, or reddish-brown, heavy clay loam to clay, underlain by a red, very heavy, plastic clay, which extends to a depth of 3 feet or more. In its typical development there is very little difference between the soil and the subsoil, but in some areas the red clay is overlain by a thin layer of material which is lighter both in color and in texture. The type is very plastic, and sticky when wet, and it cracks badly upon drying, the cracks varying in width from one-fourth to three-fourths of an inch, and extending in many cases to the depth of a foot. This soil erodes

[1] See Reconnaissance Soil Survey of Ohio, Advance Sheets, Field Operations of the Bureau of Soils, 1912, U. S. Department of Agriculture, pages 36–45, from which the above soil description and much of the topographical description is abstracted.

easily, and for this reason much damage has been done by washing. On the whole, the type is a rather strong soil, and were it not for the steepness of the slopes and the difficulty of cultivation it would be prized much more highly than it is.

Under the residual shale and sandstone soils another series of soils, designated the Meigs series, has been established. It represents a

FIG. 3.—Scenes representative of the topography of Palmer Township. In the upper picture the surface features grade from rolling to hilly, with steep slopes occurring here and there. In the lower picture the greater part of the surface grades from hilly to steep, with occasional small areas of rolling or plateau-like land near the crests of the slopes. Approximately one-half of the entire surface of these farms grades from rolling to hilly, and one-third from hilly to steep.

gradation between Dekalb silt loam and the Upshur clay, or a mixture of the materials constituting them.

The farmers' estimates of the proportion of their farms represented by each of these soil types were as follows:

Dekalb silt loam (locally known as white or yellow soil), 44 per cent.

Upshur clay (locally known as red clay land), 8 per cent.

Meigs (locally known as mixed soil), 48 per cent.

TOPOGRAPHY.

The hill country proper of Ohio, which includes the township studied, is well described as consisting of a succession of hills and

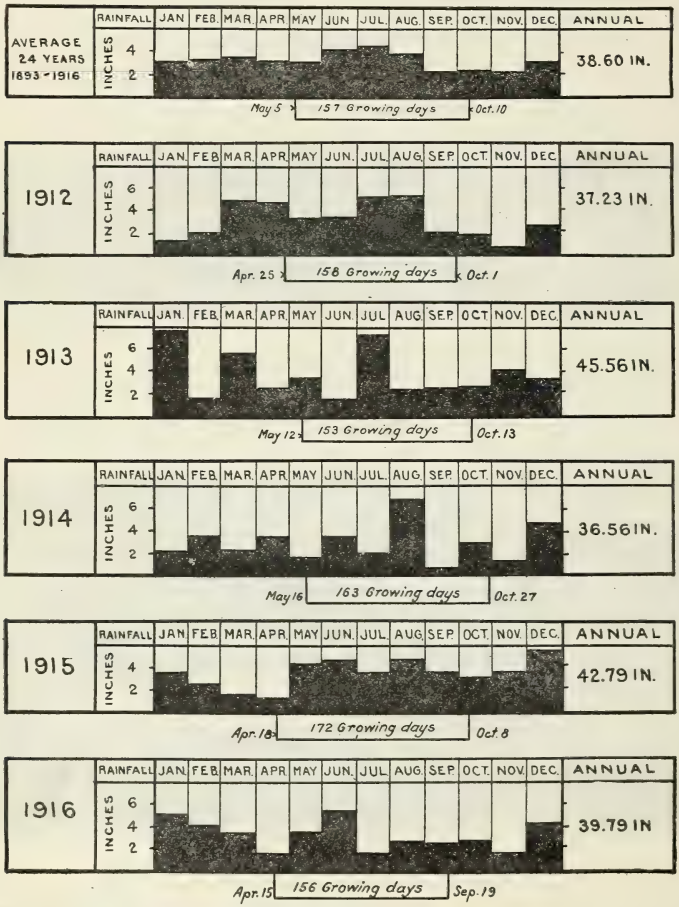

FIG. 4.—Monthly rainfall at Amesville, Ohio, for each year covered by the study, 1912 to 1916, inclusive, and the 24-year average, together with the number of growing days from the date of the last killing frost in the spring to the first killing frost in the fall.

sharp-winding ridges, separated by deep, narrow valleys. The hilly country represents the western extension of the Allegheny Plateau, which has been so deeply eroded and dissected that all remnants of the plateau surface have been removed. The greatest amount of dissection has taken place along the Ohio River and its larger tribu-

taries, where the hills rise rather abruptly to an altitude of 300 to 500 feet above the streams. As a rule the slopes are very steep and more or less benchy, while the crests of the ridges are narrow, sharp, and irregular. Back from the main streams (Palmer Township is so situated) the streams of a minor character have not cut so deeply, and the hill slopes, as a whole, are less steep, the crests of the ridges more rounded, and the altitude above the valleys is not so great. Throughout practically all of the hilly section the surface features are so uneven that the ridge-crest roads are not free from heavy grades. (See fig. 3.)

The elevation of Palmer Township varies from 680 to 955 feet above sea level.[1] Most parts are very steep and broken, but there are several small areas with surfaces slightly rolling. Large unbroken fields, however, are seldom found.

CLIMATE.

The region is one of cool winters, the average winter temperature being about freezing. The summers are moderately hot, with an average temperature just above 70°. The rainfall is about 40 inches a year. March usually has the largest number of rainy days, the average being 12, and September the smallest number, with an average of 7.

The diagrams in figure 4 show graphically the monthly rainfall and the growing season, from the last killing frost in the spring to the first killing frost in the fall, for each of the years included in the survey; also the average rainfall during the last 24 years and the growing season during the last 13 years.[2]

TYPE OF FARMING.

The farmers of this section practice a general or mixed type of farming, which doubtless has been partly determined by the topography, the character of the soil, and the marketing facilities. About one-half of the land is used as pasturage for beef cattle and fine-wooled sheep, and one-fourth in growing feed crops for the live stock kept on these farms. The type here followed is practically the same as that found throughout the hill section.

Of the crops grown, corn, wheat, and hay are considered the major crops, while oats and soy beans are frequently grown as minor crops. More of each of these crops is used on the farms for feed, seed, or household purposes than is sold. Of the total production, one-third of the wheat is sold, one-sixth of the hay, one-tenth of the oats, and

[1] Topographical map of the State of Ohio, U. S. Geological Survey.

[2] The data contained in this graph wer ecompiled by Mr. W. G. Reed from the observations of the U. S. Weather Bureau located at Amesville, Athens County, Ohio, a distance of 14 miles, and with weather conditions similar to those in Palmer Township.

one-eighteenth of the corn. Practically all farms have small apple orchards. Most of these were intended primarily for home use, although a few are used commercially in a small way after the household needs have been supplied.

In addition to beef cattle and fine-wooled sheep, nearly one-half of the farms have flocks of over 150 chickens, and these form one of the important enterprises of the township. The production of market hogs is also important, although somewhat limited on account of the limited production of corn. Some of the farms raise one or two colts a year, but the production of colts for the last five years has been of comparatively minor importance for the entire township.

FARM TENURE.

Only a small percentage of the farmers in Palmer Township were tenants. This condition holds good for the entire hill section. The 1910 census shows that 18 per cent of the farmers in the hill counties of Ohio were tenants, while in the more level counties of the State, 31 per cent were tenants. Some owners in this area rented other land, usually a field or two, which they farmed with their own land as a farm unit. Since there were so few tenants, and the additional acreage rented by owners was so small in most cases, the data for such farms have been summarized and used in this bulletin as though the operator owned all the land he farmed.

METHOD OF STUDY.

During November and December, 1912, the writer visited the farmers of Palmer Township and made a record of a year's business transactions of these farms, together with an inventory of the farm investment for the beginning and the end of the farm year.[1] This year extended from November 1, 1911, to November 1, 1912, and it is designated as "the farm year 1912" in this bulletin. This visit was repeated each fall for four additional years, and records of each year's business transactions were taken.[2]

Each year some records were eliminated, because a large proportion of the operator's time was engaged in teaming or in some other occupation not directly connected with the farm business; because the operator rented out a considerable proportion of the crop acreage; or because the record was incomplete or obviously inaccurate.

Usable records were obtained for five years on 25 farms, and for one, two, three, or four years on 48 other farms. In this study one

[1] An outline showing a method of analyzing the farm business, together with copies of the blank forms used in this survey, may be obtained by applying to the U. S. Department of Agriculture for Farmers' Bulletin 661.

[2] During the visit in 1915 the writer was assisted by Mr. R. D. Jennings, and in 1916 by Mr. Earl D. Strait, both of the Office of Farm Management.

of the objects was to determine important yearly variations. This is best done by comparing the same farms over the five-year period. A study, based upon the data for the farms with the five-year records is, therefore, presented below.

A FIVE-YEAR STUDY OF 25 FARMS.

When studying the farming of an area from a business standpoint some advantages are derived from extending the study over a period of years rather than limiting it to a single year. A study of the yields of crops, prices received for products, expenses incurred in operating the farms, etc., when extended over a period of years will give economic information that can not be obtained from the study of a single year. By extending the study over a period of years data are furnished that show the yearly variations of the many items that enter into a year's farm business, and that define the changes taking place in the agriculture of an area. Studies like these are best made by comparing results on the same farms for several years. In this area, usable records were obtained from 25 farms every year for five consecutive years. These farms were quite representative of all those in the area, and the results derived from the study of this group, whether by years or for the entire period, should

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[1] Certain terms used in this bulletin are here defined:

Farm investment.—The value at the beginning of the farm year of all real estate, machinery, live stock, and other investment used to carry on the farm business. It includes the value of the farm dwelling, but not the household furnishings.

Receipts.—The amount received from the sale of crops, the net increase from stock, and the receipts from outside labor, rent of buildings, etc. The net increase from stock is found by subtracting the sum of the amount paid for stock purchases and the inventory value at the beginning of the year from the sum of the receipts from stock products, sales of live stock, and the inventory value at the end of the year. If the value of crops or supplies on hand was greater at the end of the year than at the beginning, the difference was considered a receipt.

Expenses.—The amount of money paid out during the year to carry on the farm business, together with the value of the unpaid labor performed by members of the family. If the value of crops or supplies at the end of the year was less than at the beginning, this was considered an expense. Household or personal expenses are not included.

Farm income.—The difference between receipts and expenses. It represents the amount of money available for the farmer's living above the value of family labor, provided he has no interest to pay on mortgages or other debts.

Labor income.—The amount that the farmer has left for his labor after 5 per cent interest on the farm investment is deducted from the farm income. It represents what he earned as a result of his year's labor after the earning power of his investment has been deducted. In addition to the labor income the farmer received a house to live in, fuel (when cut from the farm), garden products, milk, butter, eggs, etc.

Per cent on investment.—The rate returned on the farm investment after the value of the farmer's labor is deducted from the farm income. It represents what the investment earned after all expenses have been deducted and the farmer has received a fair wage for his labor.

Animal unit.—In order to compare the different classes of animals and to compute the total amount of live stock on these farms all stock has been computed in terms of animal units. In this area one horse, cow, or steer was counted as one animal unit; two head of young stock (of the above kind) were counted as one animal; 10 sheep, 5 hogs, or 100 chickens were each counted as one animal unit. The number of productive animal units includes all stock except work stock.

prove a source of valuable suggestion to other farmers of the community. The greater part of the following discussion centers around this group of 25 farms.

SUMMARY OF THE FARM BUSINESS.

A brief summary of the business conducted on these farms is presented in Table I. The data shown are averages for the 25 farms for each year from 1912 to 1916, with the five-year average in the last column.

TABLE I.—*Summary of the farm business of 25 farms for a period of five years, 1912–1916 (Palmer Township, Washington County, Ohio).*

Item.	Averages, all farms, by years.					Five-year average.
	1912	1913	1914	1915	1916	
Farm area.....acres..	158	156	156	154	156	156
Crop area.....do....	44	42	39	44	46	43
Number of productive animal units.....	13.5	14.4	15.3	14.9	16.1	14.9
Number of work stock.....	2.6	2.7	2.6	2.8	2.7	2.7
Investment.....	$6,087	$6,214	$6,422	$6,527	$6,639	$6,378
Receipts.....	868	796	934	916	1,112	925
Expenses.....	412	375	423	430	456	419
Farm income.....	456	421	511	486	656	506
Interest on investment, at 5 per cent.....	304	311	321	326	332	319
Labor income.....	152	110	190	160	324	187
Value of farmer's labor.....	$288	$281	$295	$290	$298	$290
Per cent on investment [a].....	2.8	2.2	3.4	3.0	5.4	3.4
Farm income.....	$465	$421	$511	$486	$656	$506
Value of unpaid family labor.....	86	85	92	90	82	87
Family income [b].....	542	506	603	576	738	593
Interest paid on indebtedness.....	19	19	14	12	6	14
Amount available for family living.....	523	487	589	564	732	579
	Percentage of five-year average.					
Crop yields.....per cent..	110	89	94	106	101	.....
Receipts per animal unit.....do....	93	97	99	98	113	.....
Price received for farm products....do....	91	98	99	100	112	.....
Quantity of farm products sold.....do....	108	81	101	101	109	.....

[a] After deducting farmer's labor from farm income.
[b] The sum of farm income and value of unpaid family labor, or the amount available for family living had there been no interest to pay.

For the five-year period the farms averaged 156 acres, with almost one-fourth of the area in woodland and wasteland. The surface features being somewhat hilly or broken, only 43 acres per farm were used in producing crops, with about one-half of the farm area left for pasture land. Most of the crops were fed to the stock kept on these farms. There were 2.7 work horses per farm and other live stock equivalent to 14.9 horses or cows, cattle comprising more than one-half of all the productive live stock.

The farms were worth about $30 per acre, and this, with the value of the live stock, machinery, etc., represented a farm investment of

$6,378. This investment, together with the farmer's own labor, returned receipts amounting to $925 per year, $419, or 45 per cent, of which were used for expenses in connection with the farm business. After deducting the expenses from the receipts, the farm income, or the combined earning of the investment and the farmer's own labor, was $506. With money worth 5 per cent, and this was the average rate paid by those in the area who borrowed, the farm investment should have earned $319. This amount deducted from the farm income leaves $187 for the farmer's own labor, or his labor income. On the other hand, if the value of the farmer's labor, which he estimated at $290, be first deducted from the farm income, there is left $216, or 3.4 per cent, for the earning of the farm investment. If to the farm income be added $87, the value of the unpaid family labor which was included as an expense, and then $14, the amount of interest paid on borrowed money, be deducted, there is left $579, or the amount of money available for the use of the farmer and his family.

It is well understood that a very significant proportion of the farmer's living is furnished directly by the farm. This may be considered as an addition either to the labor income or to the per cent on investment. Data from 16 farm families in Palmer Township show that the total value of three important items of the farmer's living—food, fuel, and use of a dwelling—was $400 per family. Of this amount $325, or $90 per person, was furnished directly by the farm. The farm furnished in food products $215 per family and in fuel $23, the use of the dwelling being valued at $87. Of the items bought food cost $61 per family and the fuel $14. The average family in this area consisted of 4 persons, or the equivalent of 3.6 adults.

From this table similar studies of the summary of the farm business may be made for each of the years over which the survey extended, and comparisons of the summaries, one year with another, will show the main points of difference for the various years.

The crop acreage did not vary more than an acre per farm from the five-year average except in 1914, when it was 4 acres below the average, and in 1916, when it was 3 acres above the average.

The number of productive live stock increased 20 per cent during the five years, and was accompanied with a change from sheep to cattle, the number of cattle increasing 68 per cent and that of sheep decreasing 58 per cent.

The farm investment increased each year until at the close of the period it was $552 more per farm than at the beginning. The increase in the amount of stock and the higher live-stock prices account for more than one-half of this higher investment.

The farm receipts for three years were within 6 per cent of the five-year average receipts, for one year they were almost 15 per cent below the average, and for the other year they were 20 per cent above the average.

The farm expenses increased each year except in 1913, when they were lower than for any other year. The sales were also the lowest in 1913.

The farm profits, whether measured by the labor income or by the per cent on the investment, were within 20 per cent of the five-year average for three of the years, while in 1913 they were about 40 per cent below the average, and 70 per cent above in 1916.

In 1912 one-third of the farmers were in debt, the indebtedness varying in amount from $150 to $3,000; in 1916 only 1 in 6 was in debt. During this period the mortgages on four farms were paid off with money made from the farming, and on three others the mortgages were decreased, while the amount was increased on but one. Indebtedness decreased more rapidly during the years showing greater profits, while in 1913, the year returning least profits, there was no decrease in the indebtedness.

The yield per acre of crops, the receipts per animal unit from live stock, the price received for products, and the amount of the products available for sale are all important factors with considerable variations during the different years. For comparison these are shown for each year in the summary table (Table I) as percentages of the five-year average.

The yield per acre of the more important crops for the different years varied from 89 per cent to 110 per cent of the five-year average; the receipts per animal unit from 93 per cent to 113 per cent; the price received for farm products from 91 per cent to 112 per cent; and the quantity of products sold from 81 per cent to 109 per cent.

THE FARM AREA.

The farm area for a farm includes the entire acreage operated as one farm. The land may be all owned by the operator, it may be all rented, or it may be partly owned and partly rented. Of the farm area included in this group of farms 90 per cent was owned by operators, 8 per cent cash rented, and 2 per cent share rented.

The slight variations in the farm area from year to year shown in Table I were due to variations in the acreage owned by four farmers—one selling part of his farm and three buying more land—and to yearly variations in the acreages share rented by a few farmers. The land share rented usually represented single fields and included fields in corn, wheat, oats, and hay.

About 95 per cent of the entire acreage was owned or cash rented throughout all the years, and the changes in farm area that did occur were confined to a small percentage of the entire acreage included in the 25 farms.

Land, including buildings, was valued at $30 per acre in this area. Fourteen per cent of it was too rough for cultivation at all, and regarding a much larger percentage it is questionable whether it should be cultivated. From figure 5 a general idea may be formed of the way the land was utilized. It shows the proportion that was still in woodland or waste land, the proportion that was used for pasture land, and that used for growing crops. This distribution of the farm area was rather uniform for the different years, the more important changes over the five-year period being a decrease in the proportion of woodland and waste land, with an increase in the proportion of crop land.

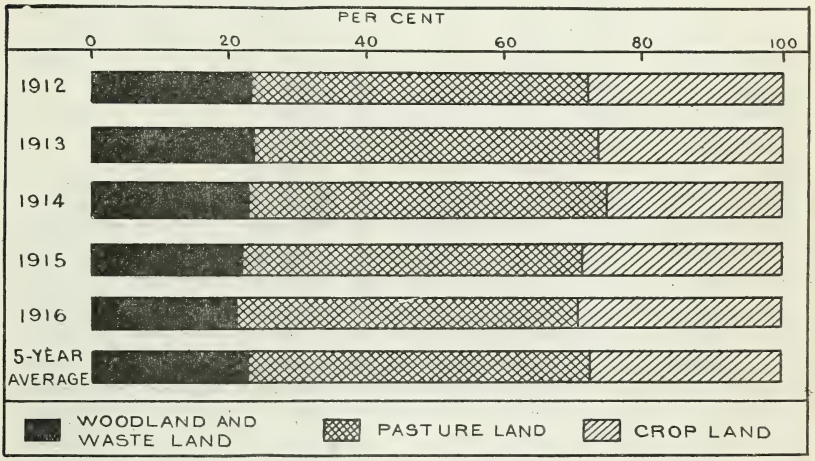


FIG. 5.—Distribution of farm area on 25 farms, Palmer Township, Washington County, Ohio.

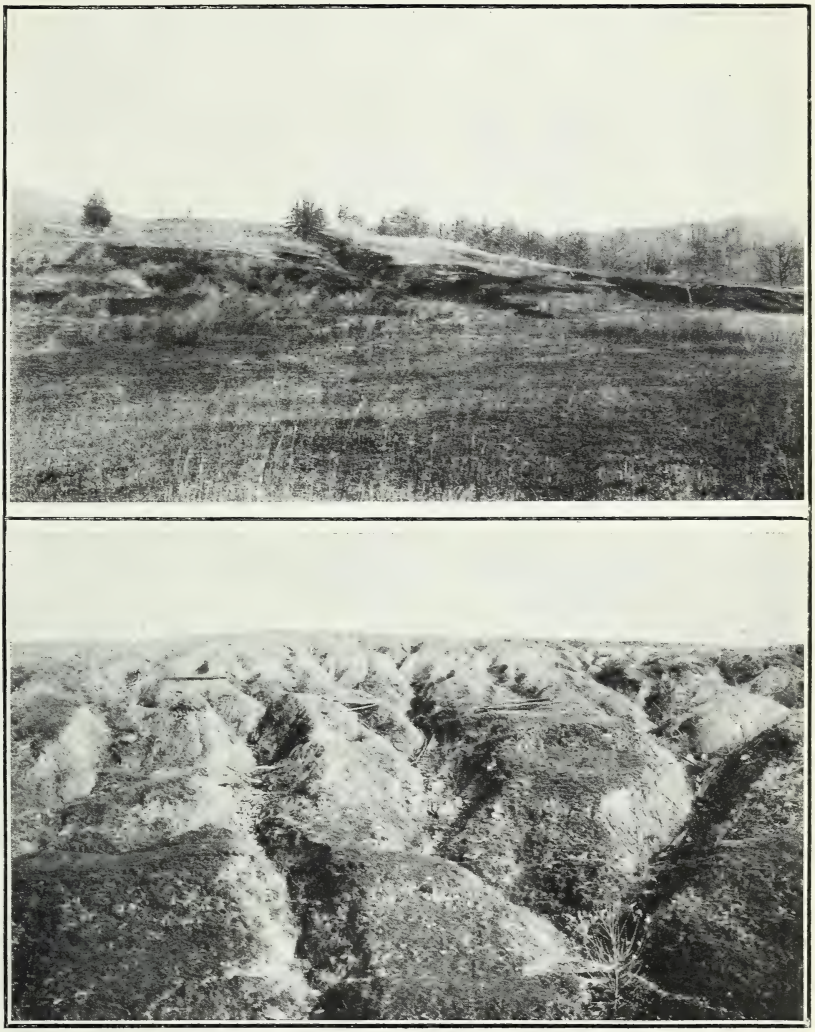
WOODLAND AND WASTE LAND.

About one-fifth of the total farm area, or 34 acres per farm, was woodland and waste land. In 1912 the acreage of each was almost equal. The acreage of waste land remained constant during the entire five-year period, but that of the woodland decreased each year until in 1916 it was only about 70 per cent of the waste land. This was due to selling timber, or having it sawed into lumber, either for sale or for use on the farms. The total acreage of woodland was 432 acres in 1912, with a decrease each succeeding year until it was 327 acres in 1916. This means that 105 acres were cut off during the five years, or about five-sixths of an acre yearly per farm. There is

still left an average of 13 acres of timber per farm, varying from none to 64 acres on different farms. At this rate the present timber

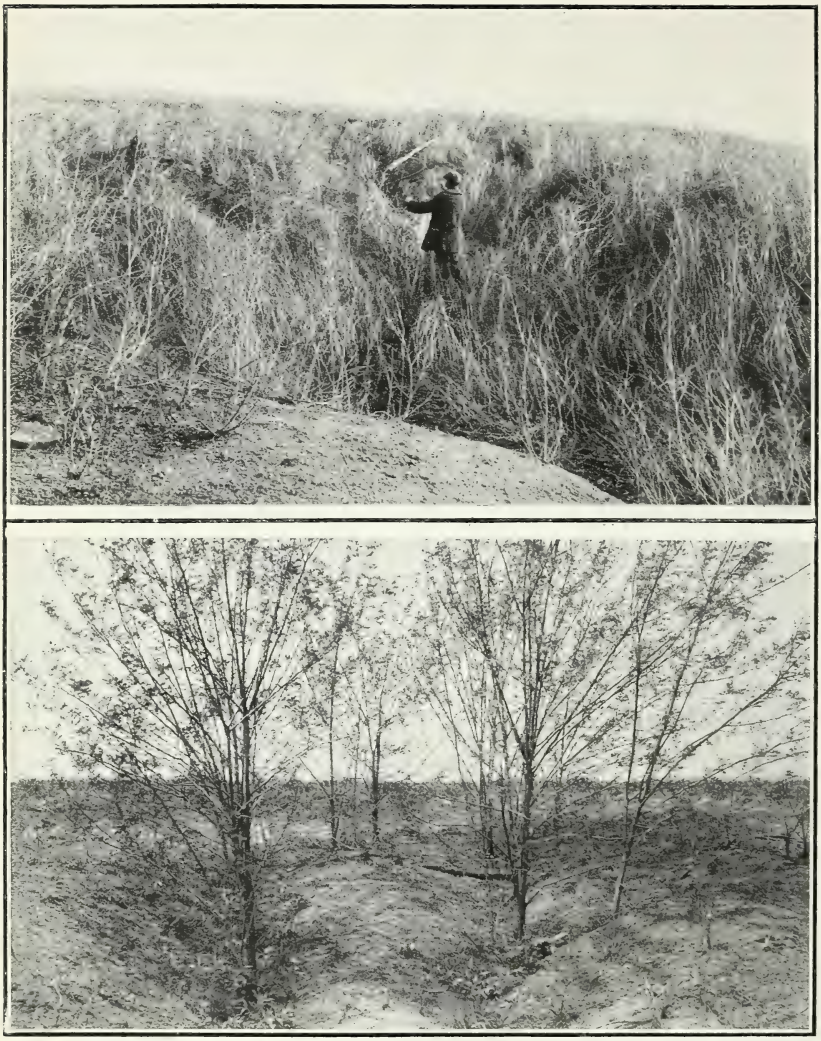
FIG. 6.—Second-growth white oaks about 50 years old. This block is about 5 acres in extent. Small areas of second-growth white oaks are found on several farms. Most of them are younger and not as large as those shown in the picture.

supply would last about 16 years, but it is probable that the timber will not be cut off at so rapid a rate in succeeding years as during the five years.



ERODED LAND.

The upper picture shows eroded land, the result of a few years' neglect after slight breaks had occurred in the sod. The lower picture shows that continued neglect has resulted in the disappearance of all grass, and in the deeper gullying of the land.



RECLAIMING ERODED LAND.

The upper picture shows the growth made by sweet clover that was sown broadcast on land after it had reached the condition shown in the lower picture in Plate I. The lower picture shows how erosion has been checked and the washes filled in after locust sprouts had been growing in the ravines of the washes for three years.

Some of the land that was cut over during the five years was cleared and either seeded for permanent pasture or used for growing cultivated crops. However, the larger portion of it remains uncleared and is growing to brush and briars. This is true also of some of the land that had been cut over a few years prior to 1912. On land that has been left this way for several years second growths of the native timber trees are noticeable, and on some of the more open parts bluegrass has obtained a stand.

Most of the land that was cut over about 20 years ago has since been handled in one of the following ways:

(1) Cleared and used for cultivated crops.

(2) After clearing, used for permanent pasture, the pasture grasses having come in voluntarily or the land having been seeded for pasture.

(3) Some blocks or clusters of second-growth white oaks that give promise for future timber supplies are permitted to remain, the underbrush in some instances being removed and in others not.

(4) Young white oaks and black walnuts when more or less scattered are sometimes permitted to remain, all less desirable species and the underbrush being removed. The land is afterwards used for pasture, the grasses coming either spontaneously or from seedings.

Figure 6 illustrates the practice described as the third method. These white oaks were estimated at about 50 years old. The photograph was taken from a block about 5 acres in extent.

Blocks of younger trees on other farms bid fair to equal these in time. On several farms part of the cut-over land has been handled as described under methods 3 and 4. With a yearly decrease in the available timber supply, it is most probable that similar practices will be used with parts of the more recently cut-over lands. To say the least, such practices are well worth consideration.

Old locust trees are scattered over the township, having been planted years ago near buildings or along fences. Clusters of young locusts are found here and there, where they have spread from the roots of stumps or from seeds scattered from older trees. On a few farms locust groves have been set out. The locust borer is a serious problem to those who desire or have tried to grow locusts. When old trees are made into posts the effects of this insect's work are readily seen, and young trees are frequently killed by this pest. In spite of the borer, however, locusts are grown in the township, and an attempt should be made to grow them on every farm. They may furnish posts for the farm, but even if they should not, they are well worth trying on rough land that is producing little or no pasture. The pasture in all probability will be improved.

Part of the waste land of this area is the result of erosion. Unprotected soils on these hillsides erode easily. Any slight breaks in the sod furnish starting places for washes and after a few years' neglect often result in a condition much like that shown in the upper illustration in Plate I. If neglected a few years longer gullies similar to those shown in the lower illustration may be worn. On several farms are areas where conditions prevail similar to those indicated in one or both of these illustrations. Such areas vary in extent from small fractions of an acre to 15 acres or more. These conditions, prevalent throughout the hill section, exist through neglect. When small breaks in the sod are first made a little grass seed and manure scattered over the bare soil will prevent further washing; but the longer the matter is neglected the more difficult it is to overcome.

The upper picture in Plate II shows sweet clover growing on land that had reached the stage indicated by the lower illustration in Plate I. While the work was only experimental, it indicates what may be done to reclaim such land. In the spring of 1913 one-half bushel of white sweet-clover seed (hulled) was sown on 4 or 5 acres of this land. The stand obtained was by no means perfect, but it was encouraging. The plants that grew from this seeding matured seed in the fall of 1914 (the white sweet clover being a biennial) and reseeded themselves. The illustration was photographed in November, 1916, shortly after the reseeding had matured its crop of seed and the foliage had dropped off. It indicates the stand obtained and the growth made from the reseeding. In a number of places on this land bluegrass and white clover were already coming in at that time.

On an adjoining farm 25 locust sprouts were set in the ravines of washed land, also in the spring of 1913. Most of these lived, and in the spring of 1917 the washes where they grew were about one-half filled in. (See lower picture, Pl. II.)

These simple experiments indicate that sweet clover sown on eroded areas and locust sprouts set in the gullies are effective means in checking erosion. The sweet clover is also a soil improver and an excellent forerunner for bluegrass pastures. It should be noted that the sweet clover thrives better on the red than on the white or yellow soils.

PASTURE LAND.

Pasture land comprises about one-half of the farm area. Fully two-thirds of the pasture land admits of cultivation, but when considering how difficult it is to cultivate and how easily the soil erodes it is hardly advisable that much of it be broken, except for occasional reseedings. Only a small proportion of the total pasture land was included in the rotation area.

The acreage used for pasture land was rather constant, the yearly range averaging from 75 acres to 79 acres per farm. The carrying capacity of this pasture land was about 5 acres per horse, cow, or equivalent, but the number of acres so required varied widely on different farms. During the five years 10 of these farms carried the equivalent of a horse or cow on 4 acres or less of pasture, while on 8 farms it required 6 or more acres of pasture land for the equivalent of each cow or horse. With about one-half of the land used for grazing and with so large a proportion of the farm receipts from live stock, the carrying capacity of the pasture land is of major importance to the farmers of this region. The practices in handling the pastures on those farms that carried as much stock on 4 or less acres of pasture land as others did on 6 or more are worthy of careful study—a closer study, indeed, than has been given them through this survey.

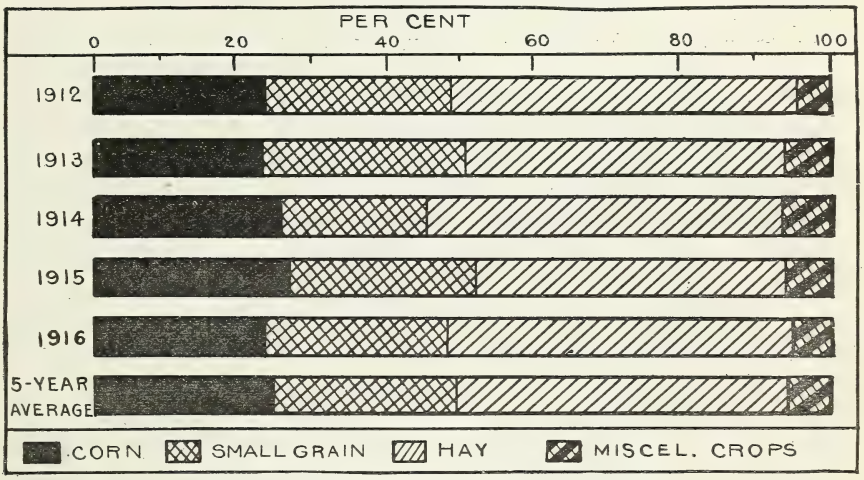


FIG. 7.—Distribution of crop area on farms studied.

THE CROP AREA.

The yearly range in crop acreage on the 25 farms has been shown in the summary table (Table I). The five-year average was 43 acres per farm. In 1916 it was 2 acres more per farm than for any other year, and in 1914 it was 3 acres less per farm than for any other year. This was the year with least wheat acreage, and it was to it that the greater part of the shortage in crop acreage in 1914 was due.

The distribution of the crop area for the years covered by this study is shown graphically in figure 7.

CORN.

About one-fourth of the crop area was in corn. These farmers aim to produce all of the feed used on the farm, and during the five

years they produced 90 per cent of the concentrates used and practically all the roughage. They considered corn their most important cereal and the cheapest source of concentrates. The importance of corn in furnishing feed for the live stock of this area may be seen from Table X, page 42. During this five-year period 56 per cent of the total feed requirements, exclusive of pasture, was supplied by corn—75 per cent of the concentrates and 32 per cent of the roughage. All farmers raised corn and much the greater part of it was grown from grain. Occasionally on a few farms a small acreage of the corn was planted so late or had eared so poorly that it was harvested for fodder only. Of the total corn acreage for the five-year period about one-sixth was used in growing corn for the silo.

Prior to the period covered by this survey there had been but one silo in the township, and it was put up in 1911. The number of silos has increased until at the close of the five-year period, November 1, 1916, there were 22 in the entire township, the greater number of which were built in 1915 and 1916. Of course, the proportion of the corn acreage grown for the silo has increased each year and decidedly so in the last two years. In 1912, 12 per cent of the corn acreage on the 25 farms was put in the silo and in 1916, 30 per cent. Whether or not putting up silos has increased the corn acreage on those farms can not be stated positively, yet the data show that on the farms which had silos during the last two years, but did not have them during the first three years, the corn acreage for the last two years had increased 13 per cent over that of the first three years, and that on the farms which have no silos the corn acreage for the last two years has increased but 5 per cent over that of the first three years. No doubt these silos were built in order that more stock might be kept, an assumption substantiated by the data from the farmers with silos and from those without. On the farms that put up silos the amount of stock kept has increased 22 per cent, while on the farms that did not put up silos the amount of stock increased but 5 per cent, or just as much as the corn acreage was increased. While the farmers who put up silos increased the amount of stock kept much more than they increased their corn acreage, yet this greater increase was not altogether because of the silos, for there was also an increase of $2.57 per animal unit in the amount of feed bought. By increasing the corn acreage 13 per cent, building silos, and purchasing a small additional amount of feed, they were enabled to keep 22 per cent more stock than they had been keeping.

A few farms were found which occasionally grew small acreages of cowpeas or soy beans, which were mixed with the corn when filling the silos.

SMALL GRAINS.

The total acreage of all crops that have been classed as small-grain crops equaled the corn acreage. These include wheat, oats, rye, timothy seed, soy beans, field beans (navy), and buckwheat.

Of these crops, wheat was of much the greatest importance, occupying about 80 per cent of the small-grain acreage. With the yields and prices usually received, many of the farmers think that growing wheat on an extensive scale would not be very profitable. Yet all of these 25 farmers usually grew limited acreages of wheat. The reasons given for growing some wheat were that it fitted well in a rotation, it was a good nurse crop for grass seedings, it was a good feed for poultry, it supplied the family with flour, and the straw furnished bedding for the live stock.

In 1914 the crop acreage was less than for any other year. This was the year with least acreage in the small grains and with the smallest proportionate acreage in small grains. This was due to a decrease in the wheat acreage.

The yearly data on wheat production on these 25 farms are shown in Table II. The point of main interest in this table is the effect of yield per acre upon the acreage sown for the following year. In 1912 the yield per acre was 14 bushels, or the same as the five-year average. Following this normal yield, a normal acreage was sown for the 1913 crop, which yielded only 9 bushels per acre. Following this low yield, two of the farmers who had been raising wheat did not sow any, and those who did sow decreased their acreages almost 25 per cent. The 1914 crop, however, produced 18 bushels per acre. The good yield for this year, together with the good prices received, was such a stimulus to greater effort for 1915 that all but one of the farmers sowed wheat, and the acreage was greater than for any previous year. The resulting crop was the largest for the five years, and, although more of this wheat was fed on the farms than during previous years, receipts from the sale of wheat were more than for any other year. The acreage for the following year was as large as that of 1915, but the yield per acre dropped to 11 bushels. It will be noticed that the amount of wheat used on these farms totaled almost 500 bushels more during 1915 than during any other year. With the larger wheat production, some of the farmers thought it better to feed wheat to poultry and hogs than to sell the wheat and buy the feeds. The price of wheat being high in 1916, all farmers sold more closely, and as a result less was used on the farms than during other years.

TABLE II.—*Total acreage and production of wheat on 25 farms for five years, 1912–1916 (Palmer Township, Washington County, Ohio).*

Item.	1912	1913	1914	1915	1916	5-year average.
Number of farms producing wheat	23	23	21	24	23	23
Acreage of wheat	230	240	164	254	254	228
Yield per acre, bushels	14	9	18	18	11	14
Production of wheat, bushels	3,353	2,184	2,918	4,616	2,540	3,122
Quantity of wheat used, bushels [a]	1,932	1,797	2,040	2,536	1,728	2,007
Quantity of wheat sold	1,421	387	878	2,080	812	1,115
Receipts from wheat	$1,393	$375	$1,046	$2,398	$1,230	$1,288
Price received per bushel	$0.98	$0.97	$1.19	$1.15	$1.52	$1.16

[a] Includes that used for bread, seed, and feed.

Only about one-half of the farmers raised oats, and statistics show that less of this crop is grown than in former years. The principal reason for this is the low yield per acre, which is usually less than 30 bushels, a very low feed value per acre. In Palmer Township, where the acreage that can well be devoted to cultivated crops is somewhat limited, it is a good farm practice to grow crops that return a comparatively high feed value per acre. An acre of corn in this area produced fully 2½ times the feed value that was produced from an acre of oats. Fields with poor stands of grass were sometimes plowed, sown to oats, and seeded again to grass. This practice is followed almost as frequently as that of growing oats in the regular rotation.

Rye has occupied an unimportant place in the crop acreage of Palmer Township. Only a few of the farmers raised rye, and then only for an occasional year or two. It was usually seeded instead of wheat, but has made very little progress in displacing wheat.

The other crops included under small grains were grown in small acreages and on scattered farms. They were of little importance to the township as a whole.

HAY.

Hay occupied 46 per cent, or almost one-half of the crop acreage. The main hay crop consisted of either clover or timothy, or clover and timothy mixed. The clover and timothy was often still further mixed with bluegrass or redtop, especially if the meadows were of more than two years' standing.

Such crops as oats, wheat, rye, millet, sorghum, cowpeas, and soy beans were occasionally reported used for hay. These occurred as small acreages, and combined they totaled only 4 per cent of the hay acreage.

Soy beans for hay have grown somewhat in favor with a number of farmers during the period of this survey. One farmer grew 2 acres in 1912 and four farmers grew 11 acres altogether in 1916. Five grew soy beans for hay in 1914, to supplement the main hay

crop, which yielded less than a ton per acre that year. Most of these men prefer the soy bean to the cowpea for a hay crop, believing it better adapted to local conditions. In growing the soy bean for hay it is essential to use varieties that make a good growth. Farmers in this area have found the medium green and some of the black varieties best adapted for hay production. They have learned also that unless soy beans have been grown on the land in recent years inoculation gives better growth.

Wheat, oats, and rye, when used for hay crops, represented acreages on which these crops had wholly or partially failed as grain crops, or for some other reason could not well be harvested as grain.

When millet, sorghum, soy beans, or cowpeas were sown for a hay crop, it was usually done in order to meet an anticipated shortage in the main hay crop. Sorghum has been grown for hay by a few farmers for several years, and with good report in most cases. Soon after cutting, it was piled in bunches in the field, where it usually remained until during the winter, when it was hauled and fed.

Some attempts to grow alfalfa have been made in Palmer Township, but most of them have failed. On the other hand, a few successes have been reported, and alfalfa can probably be grown with some degree of success on part of the land in the township. However, it must be borne in mind that the drainage, lime, fertility, and inoculation requirements of the plant must be met before it can be grown successfully.

Some farmers harvested the second crop of clover for seed. A few harvested clover seed nearly every year, while others had only an occasional crop, and 6 of the 25 had none during the entire period. The few farmers who usually had a crop of clover seed were thus enabled to supply their own needs and have a small surplus for sale. If more attention were given to growing clover, more seed could be harvested and thus the cash outlay for one of the main items in the expense for seed might be reduced. More attention should be given to growing clover, not merely for seed production, but to help maintain fertility and to furnish feed.

MISCELLANEOUS CROPS.

The area devoted to miscellaneous crops was about 5 per cent of the crop area, or 2½ acres per farm. It included the acreage devoted to fruit, potatoes, annual pasturage crops, soiling crops, and green manure. Of these, fruit was the most important, occupying about nine-tenths of the miscellaneous crop area, or a little more than 2 acres per farm. The greater part of the fruit grown was apples, although most farmers had a few peach, plum, cherry, pear, and quince trees scattered about the dooryard, in the gardens or among the apple trees. The acreage devoted to these fruits was very small and so hard to measure that it was not estimated unless the trees

occupied a definite blocked-out area. These fruits were used almost exclusively in the homes; the sales from them averaged but $4 annually per farm.

The land used for growing apples ranged from that occupied by a few scattered trees to 6 acres per farm. The apple orchards on one-half of the farms did not exceed 2 acres in size, and but 4 of the 25 farms had orchards of more than 4 acres.

Growing apples for commercial purposes has not been very profitable in this township, although the receipts of a few farms have been somewhat increased from this source. The average yearly sales of apples, including cider and vinegar, was $28 per farm for the 25 farms, with only 1 farm exceeding $100. Eight of them sold no apples during the five years. Southeastern Ohio is considered a very good section for apples, and much of the soil in Palmer Township probably is well adapted to apple production. Although the orchards of the township are fairly well cared for, pruned, sprayed, and in a few instances fertilized, few of them have been profitable. The actual yearly sales from the orchards in the last five years have been $15 per acre. The main reasons for such low returns were:

Loss from frost. Some of the orchards are located on flat land, where they do not have good air drainage as protection from frost.

Uncertainty of the crop. But one farm of all those studied had enough apples every year to have some for sale after the household need had been supplied. Most of the orchards did not bear more than two or three years in the five.

The long haul to shipping point.

Low prices, averaging $1.25 per barrel.

Some orchards had what are considered poor market varieties.

Rome Beauty, Grimes Golden, and Ben Davis are the leading market varieties of winter apples grown in this locality.

The potato acreage, aside from that of the home garden, was small, totaling 2 acres per year on six farms. For the five-year period barely enough potatoes were grown for home use. The farmers aimed to plant only enough to meet this requirement. With a good potato year some had a small surplus to sell, but with a poor year, and three of the five years were poor potato years, many of them did not raise enough for their own use.

On three scattered farms small acreages were sometimes planted to annual crops that were used for pasturage. The total area so used averaged 4 acres per year. Rye was most frequently grown for this purpose, although cowpeas, soy beans, oats, rape, and buckwheat were also reported. A few farms occasionally grew small acreages of corn, rye, or cowpeas that were fed green, and four farmers grew on an average $1\frac{1}{2}$ acres per year of rye, oats, soy beans, or cowpeas that were plowed under or disked in as green manure.

CLOVER AND LIME.

The farmers of this township have experienced difficulty in getting stands of clover; so much that some have quit sowing clover seed. When they were asked if they had any trouble in securing stands of clover, many replied, "Not if I top-dressed." Perhaps for this reason more manure has been applied as a top-dressing to wheat—to be followed with clover and timothy—than in any other manner. Most of these farms did not supply enough manure to top-dress all the wheat land each year, and the seeding of clover on these fields or parts of fields not top-dressed failed more often than on those that had been top-dressed.

Lime would aid materially in lessening the number of clover failures. Several of the farmers have used lime in a limited and experimental way within the last five years and with very few exceptions report favorable results. Most of them realize the importance of using lime, but they are at a disadvantage in getting lime to the farms, the haul is so long. The nearest available source of lime at present is a limestone crusher about a mile out from Waterford. This crusher is in operation at all times of the year when farmers would be likely to haul lime. Even though it is a big job to get lime to these farms, if each farmer would spend a day or two now and then in hauling lime, several tons could be put on each farm in a few years, and the results would be well worth the effort.

CROP ROTATION.

In the succession of crops in Palmer Township three rotation systems are practiced:

A three-crop system of corn, wheat, and grass.

A two-crop system of corn and grass.

A four-crop system of corn, oats, wheat, and grass.

The three-crop rotation was most common, with corn and wheat one year each and with a great variation in the number of years occupied by grass. Based upon this variation, the three-crop rotation may be divided as follows: A three-year rotation during which each crop was grown one year; a four-year rotation during which corn and wheat were grown one year each and grass two years; and a rotation of corn and wheat one year each followed by grass for an indefinite number of years, usually from two to five, but with extremes from one to seven years.

Only one farmer regularly practiced this three-year rotation throughout the five years, although two years ago another farmer shortened his rotation period to three years, reducing the grass for hay to one year instead of two.

A few farmers practiced the four-year rotation of corn and wheat one year each, and grass two years, but among those practicing a

three-crop rotation more grew corn and wheat one year each and then seeded to grass, which remained for an indefinite number of years, depending upon the number of years the grass maintained a good stand.

None of the farmers reported a definite time period for the two-crop rotation of corn and grass. Their main object is to keep a field in grass as long as possible. On the several fields used for the rotation, the one with poorest stand of grass is broken and planted to corn. In the fall, after the corn is cut, the land is prepared, in the same manner that land in corn was usually prepared for wheat, and seeded to grass alone. Usually clover is sown on this land the spring following. This practice seems to be just as successful in obtaining a stand of grass as when seeding with wheat.

A few farmers grew oats in their rotation, making a four-crop rotation of corn, oats, and wheat one year each, and grass for an indefinite number of years, usually two or more.

Some of the farmers reported no rotation, meaning that there was such irregularity in the succession of crops on their farms that no definite rotation prevailed. Following a crop of corn the land might be seeded to wheat or grass, or it might be bare over winter and seeded to oats the following spring. On individual farms with several rotation fields in grass, it frequently happened that there was a greater acreage with a poor stand of grass than the farmer cared to put in corn, in which case he sometimes put part of this acreage in oats and then seeded again to grass, and sometimes sowed wheat, followed by grass.

In all these rotations the grass crop was usually composed of timothy and clover mixed, although sometimes timothy was seeded alone, and occasionally redtop or bluegrass was seeded with the timothy or with the timothy and clover. In the three- and four-year rotations mentioned, the grass crop was invariably cut for hay, but in those rotations extending over an indefinite number of years, after being cut for hay from one to three years, it was sometimes pastured a few years.

The fact that practically one-fourth of the crop land was in corn, one-fourth in small grains (mainly wheat), and nearly one-half in hay, would seem to indicate that a four-year rotation of corn and wheat, one year each, and hay, two years, was a standard for this area. However, from a study of the individual farms, it by no means appears that a majority of the farmers practiced such rotation. Yet the farmers who practiced this rotation have accomplished more in the last five years than those who did not. There was more uniformity in the amount and variety of crops they produced; they accomplished more per man and per horse; they had better crop yields; they made more money.

The suggestion that this crop rotation be more generally practiced is made with a full realization of certain difficulties encountered in planning and carrying out such a system in this area. The broken character of the surface renders it difficult to arrange the desired number of fields of the same size to be used in the crop-rotation system. However, the surface features of the farms on which rotation systems have been established were no more favorable for this arrangement than are those of many of the farms lacking a definite rotation system. It is largely a question of a farmer realizing the importance of such a system. When this is once realized, by careful planning the fields of most farms can be arranged more favorably for establishing a definite crop-rotation system.

RECEIPTS.

The farm receipts in this area amounted to $925 per farm for the five-year average, ranging from $796 in 1913 to $1,112 in 1916. (See Table I). There was considerable diversity in the sources of income, as shown by the percentage distribution of the receipts in Table III. The sales of live stock, together with such products as butter, cream, eggs, and wool, amounted to $672 per farm, while the sales of crops amounted to $165 per farm. Approximately, then, almost three-fourths of the receipts were from live stock and its products.

TABLE III.—*Percentage distribution of receipts on 25 farms over a period of 5 years, 1912–1916 (Palmer Township, Washington County, Ohio).*

Item.	1912	1913	1914	1915	1916	5-year average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Crop receipts	26	10	16	20	16	18
Live stock receipts:						
Cattle[a]	19	27	23	28	31	26
Horses and colts	4	1	3	1	1	2
Sheep and wool	20	12	13	12	12	14
Hogs	7	13	16	13	13	12
Poultry and eggs	17	20	20	18	18	19
Total stock receipts	67	73	75	72	75	73
Miscellaneous receipts	7	17	9	8	9	9

[a] Includes sale of dairy products.

CATTLE.

Most of the cattle in this area represented good types of the beef breeds. A number of the bulls were pure-bred Herefords or Shorthorns, and some pure-bred cows were kept on a few farms. More receipts were obtained from cattle than from any other source. For the five-year average, cattle receipts amounted to $240 per farm, increasing from $168 in 1912 to $339 in 1916. This increase of over 100 per cent in the cattle receipts is attributed to an increase in the

number of cattle (Tables IX and XIII), higher prices received (Table XI), and the growth of dairying (Table IV).

Dairying has always been but a small part of the farm business in this area, and for the period covered by this study receipts from the sale of dairy products amounted annually to but $53 per farm, or less than one-fourth of the total cattle receipts. However, a noticeable increase in dairying has taken place during the five-year period. In 1912 the dairy receipts for none of the 25 farms exceeded $100, while in 1916 they amounted to over $100 for seven farms.

In 1912 the dairy receipts on these farms amounted to $27 per farm, and were entirely from the sale of butter. The following year one farm began shipping cream. In 1914 a cream station was operated

FIG. 8.—Cattle sales, including small quantities of butter and cream, comprise one-fourth of all the farm receipts. The yearling steers and heifers shown above are to be sold the following year. They represent the prevalent type of cattle raised in the area.

at Waterford, and in the spring of 1915 a creamery was started at Vincent. Though there has been no rapid advance in dairying in Palmer Township, the selling of cream stimulated it until in 1916 the sale of dairy products amounted to $77 per farm. This growth is shown by years in Table IV.

TABLE IV.—*Growth in dairying on 25 farms, 1912–1916 (Palmer Township, Washington County, Ohio).*

Item.	1912	1913	1914	1915	1916
Receipts from dairy products (per farm)	$27	$38	$50	$70	$77
Per cent of total farm receipts from dairy products	3	5	5	8	7
Per cent of dairy receipts from cream [a]		14	30	65	68

[a] To include all dairy products except butter.

The percentage of the total farm receipts from the sale of dairy products was less in 1916 than in 1915, not because the dairy receipts were less in 1916, but because the receipts from other sources were somewhat more.

POULTRY AND EGGS.

All farms kept poultry, and the sales of poultry and eggs constituted the second highest source of income, amounting to $169 per farm,

FIG. 9.—In Palmer Township the sales of poultry and eggs have amounted to more than those from any other source except cattle. The poultry house shown in the upper picture is typical of those on many of the farms that receive over $200 per year from the sale of poultry and eggs. It was built in 1914, with a total cash outlay of $63 for material, and accommodates 130 hens during the winter. The flock of White Leghorns in the lower picture is one of the flocks from which over $200 worth of poultry and eggs are sold each year.

of which total $138 was from the sale of eggs. Chickens represented 97.5 per cent of all poultry kept, and the sales of chickens and eggs amounted to $167 per farm, or 99 per cent of all poultry and egg receipts. On 18 of the farms all of the poultry was chickens. The prevailing breeds were the White and Brown Leghorns, although Barred Plymouth Rocks and Rhode Island Reds were also kept on some farms. Turkeys were reported on five farms and ducks or guineas on occasional farms. (See fig. 9.)

Receipts from poultry and eggs varied on individual farms from $61 to over $300. Of the 25 farms 8 received less than $100 annually from this source, 7 received from $100 to $200, and 10 received over $200. The number of chickens kept varied from 60 to 330, with an average of 164 per farm. Table V shows the average receipts per farm and per hen from the different-sized flocks. Flocks of 201 to 330 hens, with such returns as shown in the table, did not of themselves make high labor incomes for their owners, but the sales of chickens and eggs from these flocks constituted 23 per cent of the farm receipts, and the farmers made fair labor incomes. The data do not indicate that a flock of this size is the maximum-sized flock that may profitably be kept in this area, for the flocks of over 200 hens brought higher returns per hen than those of fewer than 200, and their owners realized considerably higher labor incomes. The magnitude of the poultry enterprise may well be increased on practically all farms of the township. For those who at present have small flocks it may not be desirable rapidly to increase their flocks, but they could well be gradually increased as experience and skill in the management of poultry flocks is acquired, until every farm realizes over $200 annually from the sales of chickens and eggs. In fact, the flocks in Palmer Township could safely be increased so that in a few years the income from poultry and eggs would be doubled. The poultry enterprise was the source of the largest item of income on nine of the farms and of second largest on six farms. In addition to this enterprise being one of the leading sources of income, it is further commendable because its receipts are distributed throughout the year. They are greatest during the spring and early summer months, but there is not a month of the year without some receipts from this source. Poultry is also of considerable importance as a source of the home food supply.

TABLE V.—*Relation of number of chickens kept per farm to receipts per hen on 25 farms (Palmer Township, Washington County, Ohio.).*

Classification of farms.	Number of flocks.	Average number of chickens per farm.	Receipts from chickens and eggs per farm.	Receipts per hen.
Farms keeping—				
60–100 chickens	6	88	$82	$0.93
101–200 chickens	14	156	157	1.01
201–330 chickens	5	274	295	1.08
All farms	25	164	167	1.02

As already pointed out, 40 per cent of the farms realized annually ove $200 from poultry and eggs, and this was accomplished without serious interference with the other farm operations.

In connection with the poultry enterprise, data in addition to those obtained in the regular farm management survey were gathered on a number of farms. In these cases some member of the family kept a record of the flock for the farm year 1913. The data for 11 farm flocks show that 83 per cent of the yearly egg production was sold, 3 per cent was used for hatching, and 14 per cent for household purposes. These flocks varied in size from under 100 to over 200 hens, and the annual production was 86 eggs per hen. Approximately one-half of the yearly production was during the three months March, April, and May. The lowest egg production was during November, with an increase each succeeding month until April, the month of highest production. After April there was a decrease each succeeding month until the end of the farm year (Oct. 31). The highest price received for eggs in that year was 38 cents per dozen in November, the lowest 15 cents per dozen in April. Figure 10 shows graphically a comparison of the monthly egg production and the prices received each month.

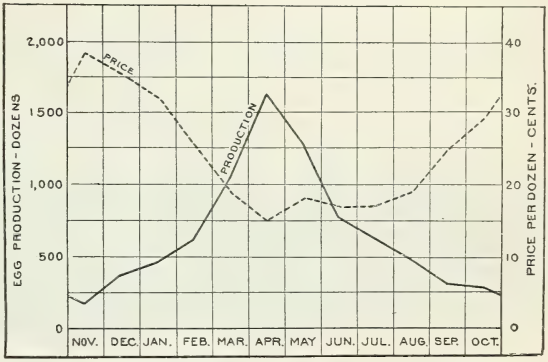


FIG. 10.—Monthly egg production and prices received on farms studied.

SHEEP AND WOOL.

Sheep were kept on 23 of the 25 farms, the number in the flocks varying from 1 to 146. For the five-year period sheep, including wool, brought the third highest item of income. Receipts from this source amounted to $128 per farm, or about one-seventh of the total. The greater part of the receipts from the sheep enterprise came through the sale of wool, which amounted to $84 per farm. All sheep reported were of the fine-wool breeds. (See fig. 11.)

Returns from sheep were low when compared with returns from other classes of stock. The receipts for each 10 head of sheep were $34.30, while those for each cow, or her equivalent in other cattle, were $31.20, for each 5 hogs $53.90, for each 100 chickens $99.80, and for each 2 colts $48.10.

The actual sales per animal unit from cattle were less than from sheep, but they did not include the value of any products used by the family. Data obtained from a number of these farms show that cattle furnished more toward the family living than any other class

of stock, and that when proper credit was given for this, the returns per animal unit from sheep were lower than those from any other class of stock.

This does not mean that sheep were unprofitable on all the farms. In reality they were profitable on some farms. Profit or lack of profit from sheep seemed due not so much to the sheep themselves as to different practices of farmers in handling them. They have been kept mainly for wool production, and on some farms were kept for several years with no other returns than the wool they produced.

A few farmers have been following the practice of keeping flocks of ewes that produced lambs in April or May. The better ewe lambs were retained, and the remainder sold, either in the fall when about 6 or 7 months old or after shearing when about 1 year old. Over one-fourth of the farmers that kept sheep have followed this practice to

FIG. 11.—Most of the farms had flocks of fine-wooled sheep, which grazed on the hillsides during the pasture season. Flocks of ewes that raised lambs which were sold at 12 to 14 months of age returned much higher receipts per head than flocks kept only for the wool they produced.

some extent and all report favorably. Table VI shows the number of sheep kept per farm, the per cent of the sheep receipts that were from wool, and the receipts per sheep for the farms that have practiced selling lambs and for those that have not. The farmers who sold lambs received $1.12 per head more from their sheep than those who did not.[1]

TABLE VI.—*Receipts per sheep for farms that practice selling lambs and for farms that do not (Palmer Township, Washington County, Ohio).*

Farm group.	Number of farms.	Number of sheep per farm.	Per cent receipts from wool.	Receipts per sheep.
Farms selling lambs	7	40	60	$4.40
Farms not selling lambs	16	38	69	3.28

[1] Sheep and wool both brought higher prices in 1917 than during the years covered by this study, and with the higher prices the farmers selling lambs still obtained higher receipts per head than those not selling them.

HOGS.

The receipts from hogs for the five-year period averaged $118 per farm, or one-eighth of the total receipts, and varied from $61 per farm in 1912 to $154 in 1914. A few of the farmers bought pigs for growing their own pork supply, but most of them kept one or two brood sows. Sixteen per cent of the farmers sold no hogs, 44 per cent sold from $42 to $100 worth, and 40 per cent sold over $100 worth. The production of hogs in this locality is necessarily limited because of the small amount of corn produced.

HORSES AND COLTS.

Horses are kept on these farms primarily for the work they do, and but few of the mares raise colts. Most of these colts, after growing into horses, are either sold or replace horses that have died or that have been sold. The receipts from horses and colts were therefore low, amounting to only $28 per farm, or about 2 per cent of the total receipts.

CROP SALES.

The total crop sales amounted to $165 per farm, or $4 less than the sales of poultry and eggs.

Almost all crops produced were represented in the crop sales, but over seven-eighths of the total crop sales were from the four crops, wheat, hay, fruit, and corn, named in the order of their importance. The remaining one-eighth of the crop receipts amounted to $18 per farm, and included the sale of clover seed, potatoes, oats, rye, soy beans, straw, fodder, cider, and vinegar.

MISCELLANEOUS RECEIPTS.

In addition to selling live stock, butter, cream, eggs, wool, and farm crops, many of the farmers received some money from the sale of lumber, posts, wood, or shackle poles, for the rent of pasture or farm buildings, for the use of part of the farm equipment, such as the farm machinery or the farm team, and for part of their own labor or time. These have all been considered receipts of the farm business and designated "miscellaneous receipts." They totaled $81 per farm, and made up a little less than one-tenth of the total farm receipts. Most of these receipts were for work done off the farms, either by the farmers alone or with their teams, and included such work as day labor on other farms, official work, road work, hauling coal, and moving oil rigs.

EXPENSES.

All costs in connection with operating the farm business above those of interest on investment and value of the farmer's own labor

are included in the farm expense. For the five-year period these averaged $419 per farm and amounted to 45 per cent, or almost one-half of the farm receipts. These expenses, with the exception of $87, the value of the unpaid family labor, all represent money paid out. The farm expenses for the different years were shown in Table I. For three of the five years they approximated the five-year average, for one year they were about 10 per cent below the average, and for 1916 they were 9 per cent above the average. For the purpose of this discussion the expenses have been grouped in six classes, viz, labor, repairs and depreciation, feed, seeds and fertilizer, taxes and insurance, and miscellaneous. The proportion each class represented of the total expenses each year and for the five-year average is shown in figure 12.

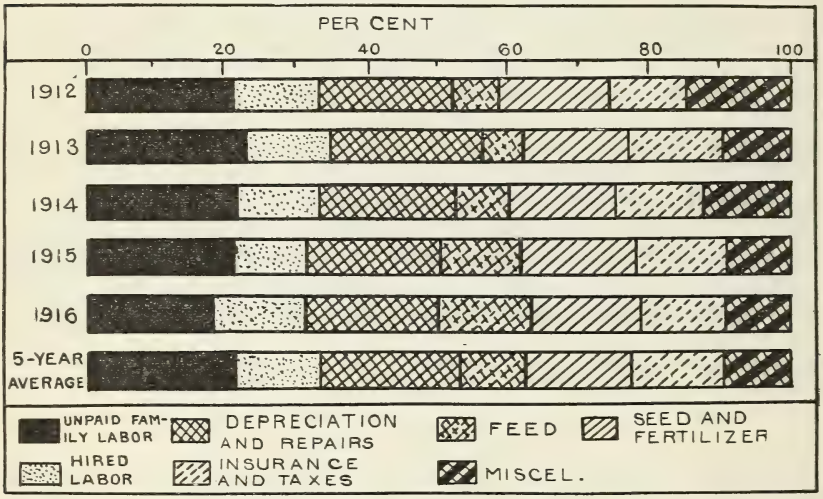


FIG. 12.—Distribution of expenses, 25 farms, Palmer Township, Washington County, Ohio.

LABOR.

The value of all labor on the farms, except that performed by the farmer himself, was $136 per farm, or about one-third of the total expenses. Of this amount, $87 was for 3.6 months of unpaid family labor and $49 for 1.6 months of hired labor. About 90 per cent of the labor was performed by the farmers and their families, with a comparatively low cash expense for labor. One farmer kept a hand throughout the year, another had a hand for six months of the year and four kept hands for a few months during the summer. In all, six farmers each had a regular hired hand for part or all of the year and with a total expense of $554 for regular hired labor. Almost as much of the labor hired, however, was for hands for a single day or a few days at a time now and then during rush periods. More or

less extra labor of this sort was hired on 24 of the farms, at a total cost of $489.

The labor expense was practically the same for the first four years, and in 1916 it was 4 per cent above the five-year average.

REPAIRS AND DEPRECIATION.

Expenses for repairs and depreciation included repairs on machinery, dwellings, other buildings, and fences, and depreciation on dwellings, other buildings, and machinery. These were all considered cash expenses. The expenses for repairing machinery, buildings, and fences represented only those actually paid out, and did not include the value of any repairs made by the farmer himself or of any repair material furnished from the farm. The expense for depreciation of machinery and buildings was equivalent to a cash expense. While we do not think of money as actually paid out for depreciation, yet it was paid for new machinery to replace that worn out, for replacing old buildings so far gone that others were built in their stead, and for such extensive repairs to buildings as would avoid the necessity of replacing them for several years.

The annual expense for repairs and depreciation amounted to $81 per farm, or 20 per cent of the total farm expenses. The expense for depreciation was about twice that of repairs.

The annual expense of all farms for repair of machinery was $4 per farm, or slightly over 1 per cent of the inventory value of the machinery; that for depreciation was $25 per farm, or nearly 8 per cent of the inventory value. The total annual cost for upkeep of machinery was $29 per farm, or 9 per cent of the inventory value. New machinery was bought to the amount of $37 per farm.

For all farms the annual expense for keeping the dwelling in repair was $6 per farm and that for depreciation was $10. The total annual expense for repairs and depreciation of the dwellings was $16 per farm, or $1\frac{2}{3}$ per cent of the value of the dwellings.

The expense for repair and depreciation of the other farm buildings was greater than that for the dwellings. The average annual repair expense was $7 per farm and that of depreciation was $18. The annual repair and depreciation expense together were $25 per farm, or just a little over 3 per cent of the value of the buildings.

The expense for fence repair includes not only slight cash expenses for repairing fences but also the cash outlay for new fencing when it is to replace that worn out. The average annual expense for keeping fences in repair on all these farms was $11 per farm, or 7 cents per acre. The reason for such a low expense for fence repair in this area may be readily seen from figure 3 (p. 7). With so many rail fences most of the fencing material was furnished by the farm without cash outlay.

FEED.

The annual expense for feed bought on all these farms was $38 per farm, or nearly 10 per cent of the total farm expenses. For all farms about one-twelfth of the feed expense was for roughage, mainly hay, and eleven-twelfths for concentrates—corn, middlings, bran, oil meal, cottonseed meal, tankage, poultry feeds, and in a few instances oats and wheat.

FERTILIZER AND SEED.

Expenses for fertilizer and seeds were $65 per farm, or about one-sixth of the total farm expense. Of this, $42 was for fertilizer and $23 for seed.

Most of the fertilizer used in Palmer Township was 14 per cent or 16 per cent acid phosphate. On a few farms steamed bone was the source of their phosphoric-acid supply, and occasionally farmers used both of these fertilizers. Some farmers used ready-mixed goods, with analysis of something like 2–8–2. Some farmers have practiced mixing fertilizers to some extent, generally using nitrate of soda, acid phosphate, and muriate of potash. Most farmers seemed to think that acid phosphate was the preferable form in which to get the supply of phosphoric acid. The expense for fertilizer included that for lime, which amounted to only a few dollars per farm.

Most of the seed expense was for clover and grass seeds. As shown on page 23, very few of these farms produced all the clover seed used on them, and the production of timothy seed received even less attention than that of clover. In reality, practically all farmers bought all the timothy seed they used. In addition to the purchase of clover and timothy seed, several farmers bought bluegrass or redtop. Of course, a farmer occasionally bought seed corn, wheat, oats, or rye, but the expense for such seeds was of little importance when compared with that for clover and grass seeds. The annual seed expense for all these farms was 50 cents per crop acre.

INSURANCE AND TAXES.

The insurance carried on buildings and contents and live stock cost $5 per farm and varied from $3 to $6 for different years. Practically all the insurance was carried in mutual companies.

Taxes amounted to $48 per farm, increasing from $45 in 1912 to $51 in 1916. The combined expense for insurance and taxes was $53 per farm, or one-eighth of all farm expenses.

MISCELLANEOUS EXPENSES.

All farm expenses not already discussed have been combined under "miscellaneous expenses." In this group were included all such

expenses as feed grinding, silo filling, fodder shredding, horseshoeing, breeding fees, veterinary, spray material, twine, thrashing, clover hulling, baling, hire of machinery, fuel and oil for farm work, rented pasture, and team work. Not one of these items of expense amounted to 2 per cent of the farm expenses, and combined they amounted to $39 per farm, or nearly one-tenth of all farm expenses. More than one-half of this amount was for the four items of horseshoeing, breeding fees, thrashing, and baling.

THE INVESTMENT.

The farm investment consists of real estate and working capital. The real-estate investment is separated into land, dwelling, and other buildings, and the working capital into live stock, machinery, feed and supplies, and cash for operating the farm business. For the five-year period the investment averaged $6,378 per farm, increasing from $6,087 in 1912 to $6,639 in 1916. The average real-estate investment for the five-year period was $4,773 per farm, or three-fourths of the total investment; the working capital was $1,605 per farm, or one-fourth of the farm investment.

The percentage distribution of the farm investment in this area from 1912 to 1916, inclusive, together with the five-year average, is shown in Table VII.

TABLE VII.—*Percentage distribution of investment on 25 farms over a period of five years, 1912–1916 (Palmer Township, Washington County, Ohio).*

Item.	1912	1913	1914	1915	1916	5-year average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Land	48	47	45	45	44	46
Dwelling	16	16	16	16	16	16
Other buildings	14	13	13	13	13	13
Real estate	78	76	74	74	73	75
Live stock	13	15	16	16	17	15
Machinery	5	5	5	5	5	5
Feed and supplies	3	3	4	4	4	4
Cash	1	1	1	1	1	1
Working capital	22	24	26	26	27	25

REAL ESTATE.

The greater part of the real-estate investment was in land, this including all farm improvements except buildings. The five-year average investment in land was $2,912 per farm, or less than one-half of the farm investment.

The dwelling as a rule represented good and substantial types of buildings. As would be expected in any farming area that had been settled for more than 100 years, the dwellings here were of widely

varying ages—some at least 75 years old, while two were built during the five-year period covered by this study. Many of the dwellings were from a third to half a century old and parts of some of them had been built originally of logs. However, most of these have been so remodeled that it would be difficult for the casual observer to distinguish them from the more recent frame dwellings. Brick dwellings were found on but two of the farms studied. Aside from these and the few that have been remodeled from old log houses, the dwell-

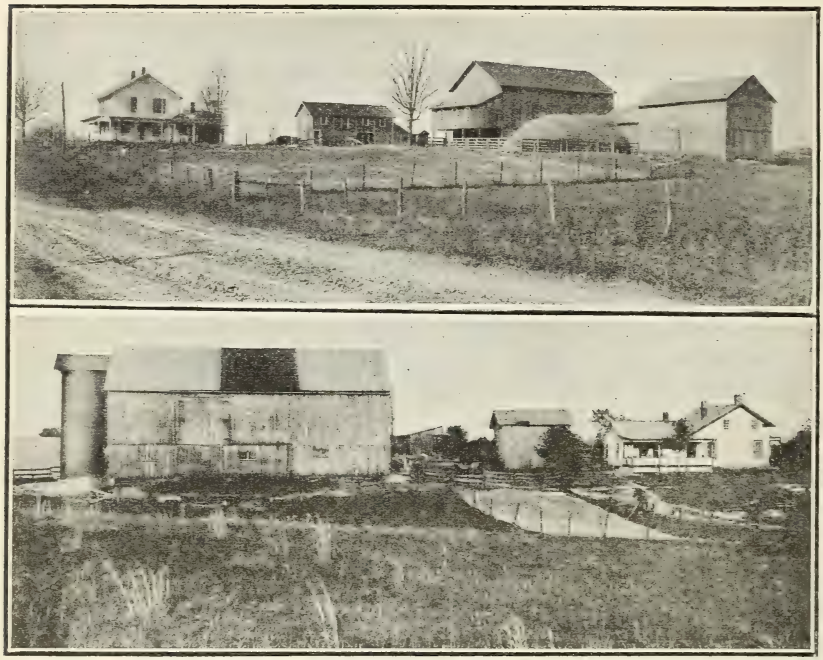


FIG. 13.—Two Palmer Township farmsteads. The dwelling shown above is one of the 27 ranging in value from $1,000 to $1,800; the one below is one of the 31 with a range of from $400 to $1,000 in value. The other buildings shown above are representative of those with values ranging from $1,000 to $1,800; those below are representative of the other buildings ranging from $400 to $1,000 in value.

ings were of frame structure. Most of the dwellings were in good repair and well painted. Several have slate roofs. Many of the farmers evidenced considerable pride in having their homesteads appear neat and attractive. (See fig. 13.)

The average value of the dwellings was $1.014, with variations from $300 to $3.500. The dwellings on one-half of the farms were valued at less than $1,000 each, on one-third of the farms at from $1,000 to $1,400 each, and on one-sixth of the farms at $1,500 or more each.

All buildings aside from the farm dwellings were listed as "other buildings." The main part of the investment in this class of build-

ings was in barns, although many farm buildings, such as sheep stables, wagon houses, corn cribs, granaries, poultry houses, and an occasional tenant house, were included with the barns. The investment in this class of buildings was $847 per farm or somewhat less than that in dwellings. It represented about one-eighth of the farm investment.

WORKING CAPITAL.

The investment in live stock represented more than one-half of the working capital. For the five-year average it amounted to $982 per farm, or about one-sixth of the farm investment.

The investment in machinery was 5 per cent of the farm investment and amounted to $319 per farm, or $7 for each acre of crops.

Feed and supplies included the value of all crops on hand at the beginning of the year that were intended to be fed on the farms or used as seed. It consisted principally of corn and hay, although wheat, oats, and timothy, clover, and soy-bean seed were also listed under feed and supplies. This investment amounted to $247 per farm, or less than 4 per cent of the total farm investment.

The average amount of cash carried on hand for use in the farm business was $57 per farm, and represented a little less than 1 per cent of the total investment.

With a gradual increase in the farm investment from 1912 to 1916, the percentage each item represented of the total investment would have been uniform from year to year if the several items had increased in the same proportion. Increase in the investment in dwellings, other buildings, machinery, feed and supplies, and in the cash used for operating the farms kept pace with the increase of the total farm investment, and shows practically the same percentage of the total investment each year. The investment in land, however, remaining about the same throughout the period, shows a yearly decrease in its percentage of the total investment. The investment in live stock, increasing more rapidly than any other item of the investment, shows a yearly increase in the percentage of the farm investment.

YIELD PER ACRE OF THE MORE IMPORTANT CROPS.

The yield per acre of the important crops over the five-year period, as shown in Table VIII, was much greater than the acreage variation of these crops. In 1912, 1914, and 1915 the yields of corn were practically the same, while 1913 was decidedly the best corn year and 1916 the poorest.

Wheat gave an average yield in 1912, with low yields in 1913 and 1916 and with good yields in 1914 and 1915.

Hay yielded 1½ tons per acre in 1912 and 1916, the best two hay years, while in 1914, the poorest hay year, the yield was slightly less than 1 ton.

For each crop there were good years and poor years, but in no year were all crops good or all crops poor. The year 1912 had average corn and wheat yields and good oat and hay yields; 1913 had good corn yield, average oat yield, and low wheat and hay yields; 1914 had an average corn yield, good wheat yield, and low oat and hay yields; 1915 had average yields of corn, oats, and hay and a good wheat yield; in 1916 the yields of corn, wheat, and oats were low, while that of hay was good. There was no year without some good crop, so that each year had a fair amount of feed for the stock. The crop yields, as a whole, were highest in 1912 and lowest in 1913.

TABLE VIII.—*Yield per acre of the principal crops on 25 farms over a period of five years, 1912–1916 (Palmer Township, Washington County, Ohio).*

Crop.	1912	1913	1914	1915	1916	Five-year average.
Corn.....bushels..	43	52	43	44	35	44
Wheat.....do....	14	9	18	18	11	14
Oats.....do....	34	31	25	28	24	29
Hay.....tons..	1.5	1.1	.9	1.2	1.5	1.2

The reason assigned for the poor wheat crop in 1913 was injury from Hessian fly and for the poor crop in 1916, winter killing. The reason for yearly variation in the yields of corn and hay may best be found in the rainfall diagram on page 8. It is generally considered by those who have made correlations between rainfall and corn yields that the amount of rainfall during the month of July greatly influences the corn yields. July, 1913, had greater rainfall than any other July of the five-year period, and it was the year with best corn yields. On the other hand, July, 1916, had less rainfall than any other July of the period, and 1916 was the year with lowest corn yields. July, 1914, had little rainfall, but the season being the latest of any of the five years, the rains of early August sufficiently offset the July drought so that the corn yield for that year was about normal.

The total rainfall during the months March to June, inclusive, or during the growing season for hay, was greatest in 1912 and 1916, the two years with best hay yields, and least in 1914, the year with lowest hay yields.

THE KIND AND AMOUNT OF LIVE STOCK.

The total amount of live stock kept each year is shown in Table IX, together with the percentage each kind represented of the total productive live stock. There was a gradual yearly increase in the

amount of stock kept on these farms, with the single exception of 1915, when it was slightly less than in 1914. While this increase in stock was only 2.6 animal units from 1912 to 1916, yet it was an increase of 20 per cent, and, when considered in connection with the rising prices of animal products, was quite significant in increasing the labor income.

TABLE IX.—*Relative amount of live stock kept on 25 farms over a period of five years, 1912–1916 (Palmer Township, Washington County, Ohio).*

Distribution of animal units.	1912	1913	1914	1915	1916
Total productive animal units per farm	13.5	14.4	15.3	14.9	16.1
Percentage of total productive animal units in—					
Cattle	41	45	49	53	58
Horses and colts [a]	4	4	4	4	4
Sheep	35	28	21	19	17
Hogs	9	11	15	13	10
Poultry	11	12	11	11	11

[a] Does not include work stock.

With a gradual increase in the amount of stock kept there were also changes in the number of stock of the different kinds, especially in cattle and sheep. The number of cattle increased 68 per cent from 1912 to 1916 and the number of sheep decreased 58 per cent during the same period. Both the increase of cattle and the decrease of sheep represented gradual changes. There were more cattle and fewer sheep each succeeding year.

THE AMOUNT OF FEED REQUIRED FOR LIVE STOCK.

The feeds produced on the farms for live-stock consumption in this area were corn, small grains, and hay. While a small quantity of feed was bought, the bulk of the feed, exclusive of pasture, was derived from these crops. To determine the relative importance of these crops as sources of feed, and the amount of feed required per animal unit per annum for the live stock kept on the farms in this area, a system was used for reducing the feeds to a common standard. This standard, known as a feed unit, represents the expression of all feeds consumed when compared with the feeding value of a pound of corn. In the footnote under Table X is given the relative value of each feed used on these farms.

The percentage of the total feed units derived from each kind of feed that has been fed by 25 farmers during each year of the five-year period and the average number of feed units they fed per animal unit are given in Table X. This table may be practically applied in two ways:

(1) With a given number of stock one can readily approximate the total quantity of feed that will be required, the proportion of concentrates and of roughage.

(2) With given quantities of various feeds, one can approximate the number of stock he will be able to carry, and determine if the feed is fairly well apportioned between concentrates and roughage.

For these purposes the average over the five-year period should be used for the standard, while the extremes in the different years may be used to indicate possible variations.

TABLE X.—*Percentage of total feed units from each kind of feed and the number of feed units per animal unit on 25 farms over a period of 5 years, 1912–1916 (Palmer Township, Washington County, Ohio).*

Distribution of feed units.	1912	1913	1914	1915	1916	Five-year average.
Percentage of total feed units [a] from—						
Corn (grain)	47	42	46	43	36	42
Wheat	10	7	6	5	7	7
Oats	3	2	1	1	1	2
Rye			(b)	1	(b)	(b)
Bought feed	4	3	4	6	7	5
Corn fodder (stover)	11	9	9	9	7	9
Corn silage		4	4	4	10	5
Hay	25	33	30	31	32	30
Concentrates, per cent of total feed units	64	54	57	56	51	56
Roughage, per cent of total feed units	36	46	43	44	49	44
Number of feed units per animal unit [c]	2,365	2,745	2,846	2,711	2,698	2,673
Number of acres of pasture per animal unit [d]	5.2	5.0	4.9	4.7	4.5	4.9

[a] A "feed unit" represents the feed value of a pound of corn or its equivalent.
1 bushel corn=56 feed units.
1 bushel wheat=60 feed units.
1 bushel oats=29.1 feed units.
1 bushel rye=56 feed units.
1 ton bought feed=2,000 feed units.
1 ton fodder (stover)=500 feed units.
1 ton silage=333 feed units.
1 ton hay=800 feed units.
Feed units computed according to table in Wisconsin Circular No. 37, June, 1912.

[b] Less than one-half of 1 per cent.

[c] In calculating the number of feed units per animal unit, straw when used as feed was not considered, neither was pasture. The feed value of pasture is generally placed at 8 to 10 feed units per animal unit daily.

[d] Includes animal units for work stock but not for poultry.

The following example will serve as an illustration of the first way in which the table may be applied:

A farmer keeps 6 cows, 1 bull, 3 horses, 50 ewes, 2 brood sows, and 250 chickens. He will raise or feed out 1 heifer, 4 steers, 6 calves, 50 lambs, 40 hogs, and 120 chickens. He wishes to determine the quantity of feed required. The above stock is the equivalent of 39 mature horses or cows. With 2,673 feed units required for each animal, the total feed requirement is 104,247 feed units. The concentrates required for feed, as shown in this table, are 56 per cent of this total, or 58,378 feed units, which is the equivalent of 1,042 bushels of corn. The roughage required is 44 per cent of the total, or 45,869 feed units, the equivalent of 57 tons of hay. Were corn the only concentrate used, and hay the only roughage, these would be the approximate quantities required. But in this area wheat, rye, oats, and various bought feeds, such as bran, middlings, oil meal, cottonseed meal, and tankage, are also sources of concentrate feeds, and

silage and corn stover as well as hay are used for roughage. As shown in Table X, the number of feed units of corn is 42 per cent of the total, or 43,784, and this divided by 56, which represents the feed units value of a bushel of corn, is 782, or the number of bushels of corn required. After making a similar calculation for each kind of feed, the following approximate feed requirements for the above stock are obtained:

Concentrates.			Roughage.		
Corn	bushels	782	Corn fodder (stover)	tons	19
Wheat	do	122	Silage	do	16
Oats	do	72	Mixed hay	do	39
Bought feed	tons	2.6			

To illustrate the second way in which the table may be applied:

A farmer has for feeding, 500 bushels corn, 50 bushels wheat, 12 tons corn stover, and 23 tons mixed hay. He wishes to determine the amount of stock he can carry. The corn and wheat have the feed value of 31,000 feed units ($500\times56+50\times60=31.000$), and the corn stover and hay that of 24,400 feed units ($12\times500+23\times800=24,400$), or a total of 55,400 feed units. The total divided by 2,673 equals 20+, or the approximate number of animal units he can expect to carry without the purchase of additional feed. The concentrates in this case are 56 per cent of the total feed units and the roughage 44 per cent, or in the same proportion as the average for the 25 farms over the 5-year period.

On these farms most of the stock were on pasture during the pasture season, but the pasture consumed has not been included in the feed requirements. The feed value of pasture is generally placed at 8 to 10 feed units daily per animal unit. Occasionally some straw was fed, but the quantity was very small, and it was not included in calculating the feed requirements.

THE SOURCES OF SUPPLY AND DEATH RATE FOR THE DIFFERENT CLASSES OF LIVE STOCK.

Since live stock with its products is the source of so large a part of the income in this area, some data as to the sources of supply of the different classes of stock, together with the losses, are presented here. These data are for the 25 farms over the five-year period, and in the case of live-stock losses represent what ordinarily may be expected.

The work stock consisted almost entirely of horses. Some of the farmers kept the same work horses throughout the five-year period; others changed all their horses, and still others changed some of them. Fifteen per cent of the work horses were changed each year, three-fourths of which were sold and one-fourth of which died. This indicates that the work horses are kept on the same farms for an average of $6\frac{2}{3}$ years. The horses disposed of were replaced by colts and by purchases—almost an equal number from each source. The

death rate for work horses was 4.2 per cent. The rate of depreciation for all work stock kept on these 25 farms during the five years was 4.1 per cent annually. Twice as many colts were foaled during this period as there were horses that died, and 30 per cent more horses were sold than bought. The number of colts raised was more than sufficient to meet the death rate for the horses, although the latter might have been somewhat higher were it not that several horses were replaced before they became very old.

Cows were replaced just about as frequently as horses, the percentage of the total number disposed of annually being 14.7 per cent, indicating that the average time cows are kept on the same farm was 6.9 years. The death rate for cows was 1.4 per cent, or much lower than for horses. One-fourth of the cows were replaced by purchase and three-fourths by heifers from the home farm. About one-half of the heifers raised became cows and one-half were sold as beef stock. For the five-year period the average annual production of calves was 89 per cent of the number of cows kept. About 85 per cent of the calves were kept until they were over a year old. Some were sold as yearlings, but the greater number, excepting the heifers that became cows, were carried over another year and sold as 2-year-olds. For all cattle the death rate was 2.9 per cent, of which one-half were calves under 1 year old.

The main source of the sheep supply for each farm was lambs raised on the farm. There was some buying and selling of sheep among the farmers, but 80 per cent of the sheep were raised. Sheep losses were greater than those of any other class of stock, the death rate being 7.7 per cent annually. The loss from dogs was insignificant when compared with that from other causes. The greater part of the losses were caused by the stomach worm.

Almost 90 per cent of the hogs fed out on these farms were farrowed on the farms on which they were fed. The sows usually produced two litters a year, and the average number of pigs was 10.5 per sow annually. The death rate among sows was 6 per cent, and that for all hogs 4.8 per cent.

FACTORS AFFECTING FARM PROFITS.

The profits from year to year for the farms in this area are shown in Table I, on page 12. In 1912, 1914, and 1915 the profits were about normal, being within 20 per cent of the five-year average. The year 1913 was the poorest year and 1916 the best, whether the profits be determined by the labor income or by the per cent received on the investment. The labor income in 1913 was 40 per cent below the five-year average, and in 1916 it was 70 per cent above the average, or almost three times that of the poorest year. These were also the years with respectively the least and the greatest amounts of money

available for the farmers and their families, and when the least and the greatest reductions were made in the farm indebtedness.

The year of least profits was the year with lowest wheat yields; the apple crop was also almost a failure. Wool sold lower, and the price of sheep was lower than in any other year, except 1914. Had the sales of these four items amounted to as much as the five-year average, the profits in 1913 would have reached those for the five-year average.

The main factors contributing to the greater profits of 1916 were the higher prices received for most farm products and the greater quantities sold of a few products. All classes of live stock, as well as eggs and wool, brought higher prices in 1916 than in any other year. All crops, except hay and clover seed, sold higher in 1916 than the five-year average, although a few crops brought higher prices some other years than in 1916. (See Table XI.)

TABLE XI.—*Prices received for farm products on 25 farms over a period of five years, 1912–1916 (Palmer Township, Washington County, Ohio).*

Product.	Unit.	1912	1913	1914	1915	1916	Five-year average.
Corn	Bushel	$0.46	$0.76	$0.76	$0.72	$0.81	$0.70
Wheat	do	.98	.97	1.19	1.15	1.52	1.16
Oats	do	.35	.64		.45	.50	.48
Rye	do	.62	1.07	1.00			.90
Hay	Ton	11.38	13.73	14.67	11.81	8.75	12.07
Potatoes	Bushel	.59	1.00	1.50	.51	1.54	1.03
Clover seed	do	12.00	7.00	9.33	10.34	9.10	9.55
Apples	Barrel	1.40	1.00	1.05	1.44	1.35	1.25
Eggs	Dozen	.19	.19	.19	.19	.22	.20
Wool	Pound	.23	.20	.25	.26	.31	.25
Cattle	Cwt.	5.70	7.13	6.97	7.29	8.20	7.07
Sheep	Head	3.22	3.00	2.97	4.30	4.56	3.61
Hogs	Cwt.	6.52	8.20	8.10	6.60	8.50	7.58
Chickens	Head	.42	.43	.41	.45	.48	.44

More cattle and clover seed were sold in 1916 than in any other year, a few more chickens than in any other year except in 1913, more hogs than in any other year except 1915, and more hay than in any other year except 1912. (See Tables XII, XIII.)

TABLE XII.—*Quantity of various farm products available for sale on 25 farms over a period of five years, 1912–1916 (Palmer Township, Washington County, Ohio.)*

Product.	Unit.	1912	1913	1914	1915	1916	Five-year average.
Corn	Bushels	721	165	702	750	410	550
Wheat	do	1,421	386	878	2,080	812	1,115
Oats	do	124	109		112	40	77
Rye	do	3	8	30			8
Hay	Tons	198	82	42	58	158	108
Potatoes	Bushels	105	40	6	254	68	95
Clover seed	do	14	8	2	7	80	22
Apples	Barrels	855	49	1,161	289	372	545
Eggs	Dozen	15,695	16,190	19,468	18,121	17,400	17,373
Wool	Pounds	10,483	10,115	7,348	7,900	8,374	8,844

The higher price for most 1916 products and the greater quantities or numbers of the products above mentioned sold both indicate that the labor income for 1916 should have exceeded that of former years even more than it did. This would be true except for two other factors, the increase in expense connected with operating the farm business and the decrease in the quantities or numbers of several farm products that were available for sale, both of which partly counteracted the higher prices received for most products.

The farm expenses in 1916 were greater than for any of the other years and 11 per cent more than the average for the five years. Most of this increase was for feed and hired labor. The expense for roughage feed in 1916 was slightly less than the five-year average, while that for concentrates was 72 per cent more than the average. The quantity of concentrate feeds bought was 56 per cent more and the price 10 per cent higher. The expense for hired labor in 1916 was 28 per cent more than for the average of the five years. The number of months of hired labor was 21 per cent more and the average wages 6 per cent higher.

Aside from hay and clover seed, the quantities of all crops sold were less in 1916 than the five-year average, and there were fewer sheep and less wool sold than the five-year average.

TABLE XIII.—*Number of young stock produced over a period of five years, 1912–1916, on 25 farms (Palmer Township, Washington County, Ohio.)*

Kind of stock.	1912	1913	1914	1915	1916	Five-year average.
Calves	68	69	77	85	91	78
Colts	6	2	6	6	7	5
Lambs	291	332	193	212	215	249
Pigs	184	232	320	318	273	265

With the higher prices, but smaller quantities sold, the sales of corn, wheat, oats, and apples in 1916 were each below the five-year average, while the smaller quantities of potatoes, wool, and sheep sold were so affected by the higher price received that the sales of each in 1916 were a little above the five-year average. The higher prices for these products were so counteracted by the quantities sold that the receipts from all of them in 1916 just equaled the five-year average receipts.

The only crop with decidedly higher receipts in 1916 than in preceding years was clover seed. It was a good clover-seed year, the production was over 300 per cent of the average, and the quantity sold 363 per cent. The price received was 5 per cent below the average and the sales amounted to $29 per farm against a five-year average of $8. However, the production of clover seed has been a minor en-

terprise in the township and can not be considered of great importance in affecting profits every year.

The sales of hay in 1916 were but $7 per farm above the five-year average, the quantity sold being almost 50 per cent above the average and the price per ton 27 per cent below the average.

The 1916 crop receipts exceeded the five-year average 9 per cent, and the stock receipts, including dairy products, eggs, and wool, 25 per cent.

The single enterprise most affecting the greater 1916 profits was cattle, the receipts from which were $99 (41 per cent) more than the five-year average, owing to higher prices and more cattle sold.

The variations from year to year in the yields of the different crops, in the numbers of the different classes of stock, and in the prices received for crops and stock were so distributed above and below the average as to produce no great variations in the labor income for three of the five years. In 1916 a sufficient number of these variations were above the average, and some of them were so much above the average as to produce a labor income considerably higher than the five-year average; while in 1913 they were sufficiently below the average to depress the labor income to 40 per cent below the average. These would indicate that in such an area as this, with a well-established and well-diversified system of farming, the variations in the quantities and prices of the several crops and kinds of stock above the average are so counteracted by those below the average as to produce little change in the labor income except when there is a general change in price levels, or a decidedly poor crop year.

A STUDY OF 73 FARMS BY SIZE AND QUALITY OF BUSINESS.

SIZE OF FARM BUSINESS.

It is a well-established principle that the size of business of whatever kind is one of the leading factors affecting its profits. The principle is as applicable to the farm business as to any other, and the data shown herein accord therewith. The number of acres of crops grown on the farms in this area was quite indicative of the comparative size of the business conducted on them, and it has been used in this bulletin as the measure of the size of the farm business. For this study in size all of the farms of the area from which usable records were obtained from one to five years, 73 in number, were arranged in three groups, based on the number of acres of crops raised. Each of the 18 farms in the first group produced 30 acres or less of crops, each of the 29 farms in the second group 31 to 45 acres, and each of the 26 farms in the third group over 45 acres.[1]

[1] In addition to the 25 farms with five-year record, 48 other farms are here included—12 with two-year records, 12 with three-year records, and 12 with four-year records. The farms in each of these groups are almost equally divided among the different size groups.

A brief summary of the business conducted on these farms is presented in Table XIV. The data shown are for the average of the farms in the different-sized groups. Comparisons of these groups, one with another, will readily show that the size of the farm business is a very important factor in returning profits.

TABLE XIV.—*Summary of the farm business on 73 farms, by size of farm (crop area) (Palmer Township, Washington County, Ohio).*

[Except for number of farms, the figures are averages.]

Item.	30 crop-acres and under.	31 to 45 crop-acres.	Over 45 crop-acres.
Number of farms	18	29	26
Farm area.....acres	88	120	196
Crop area.....do	24	38	57
Number of productive animal units	8.2	11.0	18.6
Number of work stock	2.2	2.4	3
Crop yield per acre [a].....per cent	96	97	106
Receipts per animal unit [a].....do	104	98	100
Investment	$3,817	$4,860	$7,807
Receipts	484	693	1,152
Expenses	232	307	513
Farm income	252	386	639
Interest on investment at 5 per cent	191	243	390
Labor income	61	143	249
Value of farmer's labor	$236	$278	$287
Per cent on investment [b]	.4	2.2	4.5
Farm income	$252	$386	$639
Value of unpaid family labor	47	60	98
Family income [c]	299	446	737
Interest paid on indebtedness	3	13	18
Amount available for family living	296	433	719

[a] Percentage of average for all farms.
[b] After deducting value of farmer's labor from farm income.
[c] The sum of farm income and value of unpaid family labor, or the amount available for family living had there been no interest to pay.

The farmers producing 45 acres or more of crops, on apparently no better land, used a little more fertilizer per crop acre and obtained better yields than the farmers obtained who produced a smaller acreage of crops.

On the small farms the receipts per animal unit were slightly more than on the large farms. This was mainly due to the proportionate numbers of the different kinds of stock on the farms of different size. Poultry represents a slightly higher percentage of the total productive live stock on the farms with 30 acres or less of crops and returned higher receipts than any other kind of live stock.

The proportion of the farm area in woodland and waste land, in pasture land and in crop land was quite uniform in the different size groups, but the proportion of the crop land in corn and in the small grains varied somewhat on the different-sized farms. On the farms with 30 acres or under of crops the corn acreage was somewhat more than the small-grain acreage; on the farms with 31 to 45 acres of crops the acreage of each was about equal; and on the farms with

over 45 acres of crops the acreage of small grains exceeded that of corn. That the farmers who did not raise over 30 acres of crops had a greater proportion of the crop area in corn and a smaller proportion in small grains than those who raised larger acreages of crops is quite natural, when the number of stock kept on the different groups of farms is considered in connection with the fact that practically all the feed consumed on these farms is produced on them and that the farmers consider corn the cheapest source of concentrates.

The average amount of stock kept on the farms with 30 acres or under of crops was 2¼ work horses, 2½ cows, 4 head of young cattle, 13 sheep, 5 hogs, and 110 chickens. This complement of stock required concentrates equivalent to 280 bushels of corn and roughage equivalent to 12 tons of hay. With the average yields of corn and hay on this group of farms it would require 7 acres of corn and 11 acres of hay to produce the required amount of feed, and these correspond with the acreages actually raised. These farms had an average crop area of only 24 acres. With 18 acres used in aiming to grow enough feed for the stock, and with 2 acres in fruit, etc., it may readily be seen that only 4 acres, or a considerably smaller area than the acreage in corn, could be used in growing small grains.

The farmers with 31 to 45 acres of crops would require 10 acres of corn and 16 acres of hay to grow all the feed required for the stock they kept. They did grow 9 acres of corn and 17 acres of hay, or practically enough feed for their stock. With 26 acres used in growing corn and hay and 2 acres in fruit, etc., they had left of their total crop area of 38 acres 10 acres that were used in growing small grains.

The farmers that raised over 45 acres of crops would require 13 acres of corn and 22 acres of hay to produce all the feed required for the stock they kept. They did grow 13 acres of corn and 26 acres of hay, or a little larger acreage than required to furnish feed for the stock. Thus, with 39 acres used in growing corn and hay and 3 acres in fruit, etc., they had left from their total crop area of 57 acres 15 acres that were used in growing small grains.

Fewer silos have been built on the farms with 30 acres of crops or under than on the larger farms. Only three of these farms have silos, and two of these were not filled in 1916. The farms with so small a crop acreage seldom raise enough corn to fill a silo and have enough grain feed for a minimum number of stock. They more often do not raise enough to fill a silo. Of the farms with 30 acres and under of crops, one in six had silos in November, 1916; of those with 31 to 45 acres of crops, one in four had silos; and of those with over 45 acres of crops almost one-half had silos.

Most of the sheep were found in the larger farms, the flocks being larger on the large farms than on the small farms, and a greater

percentage of the farms keeping sheep. The receipts from the sale of sheep and wool were $183 per farm, or one-sixth of the total receipts on the large farms, while they were $50 per farm, or one-tenth of the total receipts on the small farms.

On the small farms the percentage of the total receipts from crops was much smaller than on the larger farms, the result of a smaller percentage of the crop area being in wheat. On the other hand, a larger percentage of the farm receipts were obtained from poultry on the small farms.

The small farms used a somewhat higher percentage of the farm receipts for expenses in operating the farm business than did the larger farms. The proportion of the total expenses for hired labor was a little less on the smaller farms, but that for depreciation and repairs and for feed was somewhat more. The other items of expense represented about the same percentage of the total expenses for all groups.

On the small farms the investment in land was proportionately less and that in dwellings more, and at the same time the dwellings were not so good as those on the large farms. The real estate was valued $2 per acre more on the small farms.

The farms producing 45 acres or over of crops had a machinery investment of $6.11 per crop acre, while those producing 30 acres or under of crops had an investment of $7.67 per crop acre.

QUALITY OF BUSINESS.

As already shown (p. 48) the group of farms with the smallest business (smallest crop acreages) had the lowest average labor income, and the group with the largest business (largest crop acreages) had the highest average labor income. This is usually true of groups of farms, but it is not always true of individual farms; that is, not every farm having a large business has a higher income than every farm having a small business. In each size group of farms were farms with good labor incomes, and farms with poor labor incomes. These variations in labor income must have been partly due to some other cause or causes than the size of the business, and the most important other cause is the quality of business.

The quality of the farm business either for an individual farm or for groups of farms may be fairly well determined by comparing the crop yields per acre and the receipts per animal unit from live stock with the corresponding yields or receipts for all the farms studied.

Of course, the character and fertility of the soil and the climatic conditions have great influence in determining crop yields, but within a restricted area, such as that in Palmer Township, these influences

are very likely to affect one group of farms as much as another in a given year, so that it may be said safely that the variations in crop yields on different farms or groups of farms in an area with similar soil and climatic conditions are due more to variations in the farm practice on the different farms than to the conditions just named, and that the crop yields on the different farms are therefore one indication of the quality of the business conducted on them.

Receipts per animal unit are considerably affected by the prices received for the live stock and its products, by the time of selling, or by live-stock losses, but within a given area differences in receipts are often the results of actual differences in the quality of the stock or of differences in the live-stock practices on different farms. These practices, however, have been worked out or applied by the farmers after such study of the marketing problem and the problems of feeding and the care of stock as to enable them to reduce live-stock losses to a minimum and to have the right kind of stock to sell at the right time. The receipts per animal unit may therefore safely be said to be a very good indication of the quality of the live-stock part of the farm business.

The crop yields per acre and receipts per animal unit have been worked out by comparing the crop yields and receipts per animal unit on each farm for each year with the average yields and receipts for all farms for that year. This was done because the average yields of crops and receipts per animal unit were not uniform from year to year, owing generally to causes not entirely under the control of the farmers, such as weather conditions, insect injuries, or live-stock prices. Thus in this study of the effect of quality of the farm business upon profits, each farm was used as many times as there were yearly records for that farm, or a total of 245 records.

In Table XVI are shown the effects of the size and the quality of the farm business upon the labor income. In determining the effect of either of those factors, care must be exercised to make sure that the profits shown are not the resultant of a combination of the two factors, rather than of the one it is desired to study. To eliminate this source of error as far as possible, when determining the effect of quality upon farm profits, the records were grouped into three size groups (by crop area), and each of these into three groups based upon the quality of the business. From these groupings, the effect of the quality of the business upon the average labor income of groups of from 20 to 36 farm records with similar crop acreages may be noted by reading the table from left to right. The effect of the size of the business when the quality is similar may be noted by reading the table downward.

It will be seen that both size and quality have decided effects upon the labor income, and that quality is fully as important as size. The

small farms with poor quality had nothing left for the operator's labor after 5 per cent interest on the investment was deducted from the farm income. In other words, the average labor income for this group of farms was nothing. The average labor income of the large farm with poor quality was $88, while that of the small farms with good quality was $137. The medium-sized farms with medium quality had an average labor income of $125. The labor income of the large farms with medium quality was $213, while that of the medium-sized farms with good quality was $214. These figures indicate that so long as the size of the business is small and the quality poor the income may be increased more by improving the quality of the business than by increasing the size, but that with a medium-sized business with medium quality, the income may be increased as much by increasing the size, while maintaining the same quality, as by improving the quality while maintaining the same size.

TABLE XV.—*Effects of size (crop area) and quality of business upon labor income (245 farm records, Palmer Township, Washington County, Ohio).*

[Figures represent average labor income.]

Size (crop area).	Poor quality.[a]	Medium quality.[b]	Good quality.[c]
30 acres and less	.....	$72	$137
31 to 45 acres	$63	125	214
Over 45 acres	88	213	453

[a] Poor quality includes: Poor crops and poor stock; poor crops and medium stock; medium crops and poor stock.

[b] Medium quality includes: Poor crops and good stock; medium crops and medium stock; good crops and poor stock.

[c] Good quality includes: Medium crops and good stock; good crops and medium stock; good crops and good stock.

The influence of quality of the business, as shown in Table XV, is due to the combined weight of two quality factors, crop yields and receipts per animal unit. In order to determine the influence of each upon farm profits, the records were grouped so that farms with different crop yields but with similar live-stock receipts could be compared, and vice versa. These groupings show that for both crops and live stock quality had marked effects upon the average labor income, but that quality of live stock affected the income more than that of crops. The quality of the live stock had just about double the effect of the quality of the crops, and this should be expected in this area. It was pointed out on page 49 that much the greater proportion of the crops produced on these farms reached their market through the medium of the live stock rather than by selling the crop direct, and Table III shows that a much greater proportion of the farm receipts were from the live stock than from the crops. Therefore, with the type of farming followed in this area, the quality factor of first importance is the live stock. With

whatever quality of crops a farmer produces, so long as most of them are marketed through his live stock, it is more important to get good returns per animal per unit than to get higher crop yields per acre. This is not intended to minimize the importance of obtaining good crop yields, but to emphasize the importance of having a good quality of live stock.

The group of farms that had both poor crops and poor stock had an average labor income of $4 per year. The group with no better stock but with good crops had an average labor income of $134, while the group with no better crops but with good stock had an average labor income of $216.

The group of farms with medium crop yields and medium stock had an average labor income of $108. The group with no better stock but with good crop yields had an average labor income of $212, while the group with no better crops but with good stock had an average labor income of $302.

The farms with both good crops and good stock had the highest average labor income—$397.

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